

APPENDIX B

TRAFFIC IMPACT ANALYSIS

TRAFFIC IMPACT STUDY

MARION ROAD TRUNK SANITARY SEWER PROJECT: ALTERNATIVE URBAN AREAWIDE REVIEW *ROCHESTER, MN*

March 2002

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1.0 INTRODUCTION

The City of Rochester has initiated a Water Quality Protection Project to extend sanitary sewer and water to homes with failing and substandard septic systems primarily in areas with near-surface groundwater within Marion Township. The Minnesota Pollution Control Agency (MPCA) has included the completion of an Alternative Urban Areawide Review (AUAR) as a special condition of the City's permit to construct and operate the new trunk sanitary sewer and associated sub-trunks.

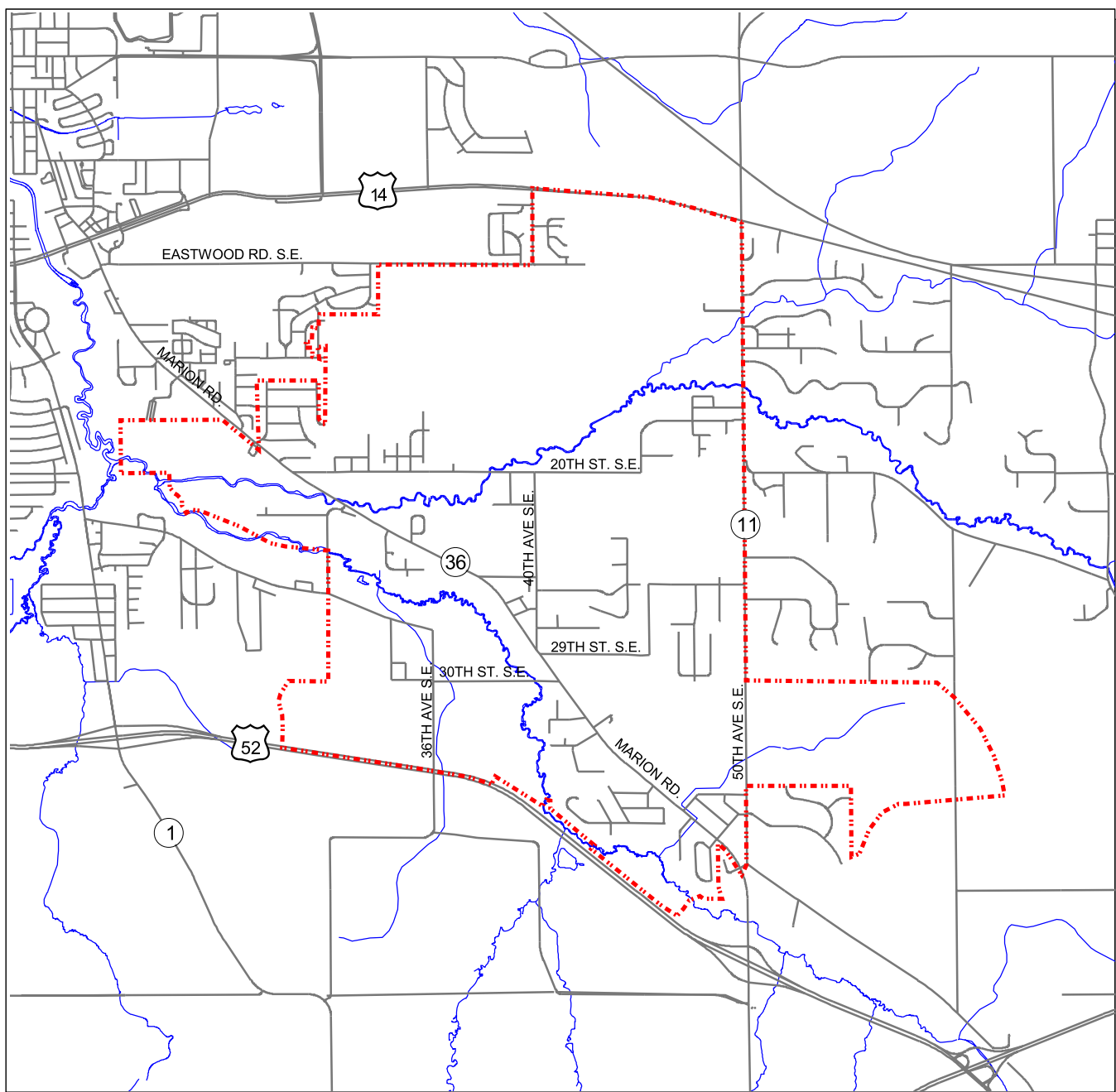
An AUAR is a type of environmental review used to assess potential cumulative environmental impacts of future urban development over a broad geographic area that may encompass several projects. The AUAR process includes the preparation of a "Mitigation Plan" that identifies methods to avoid, minimize, or mitigate unacceptable environmental impacts that may have independent or cumulative effects as future development takes place.

As part of this AUAR document, a traffic study was completed to analyze and document the expected traffic impacts of potential future land development in the sewer and water extension area. This report documents the results of the traffic study and provides information necessary to complete the AUAR document.

The AUAR project area is located in Marion Township southeast of the existing Rochester City Limits. **Figure 1-1** displays the project area boundary. Trunk Highway (TH) 14, TH 52, and 50th Avenue (CSAH 11) bound most of the project area.

The purpose of the traffic analysis is to identify potential traffic impacts associated with: existing conditions, future growth without development; and full build-out according to the hypothetical development scenario as well as identify strategies for addressing these potential impacts. The following elements were included in this study:

- Existing Conditions
- Future Conditions
- Improvement and Mitigation Plan and Issues
- Future System and Right-of-Way Considerations
- Other Modes
- Summary/Conclusions



Legend

Informational Items

- Existing Streets
- AUAR Project Area
- Water

0 0.5 1 1.5 2 2.5 Miles



Figure 1-1
Project Location

2.0 EXISTING CONDITIONS

Currently, the project area is largely undeveloped but has scattered residential developments of varying densities along with pockets of commercial and industrial development along Marion Road. In order to analyze the traffic impacts associated with the existing development, key intersections and road segments were identified, traffic data was obtained at these locations, and the quality of traffic operations at these locations was estimated.

2.1 Key Intersections Analyzed

The key intersections selected in southeast Rochester for analysis as part of this traffic study include:

1. TH 14 / Marion Road
2. TH 14 / 40th Avenue
3. Marion Road / Eastwood Road
4. Marion Road / 20th Street
5. Marion Road / 40th Avenue

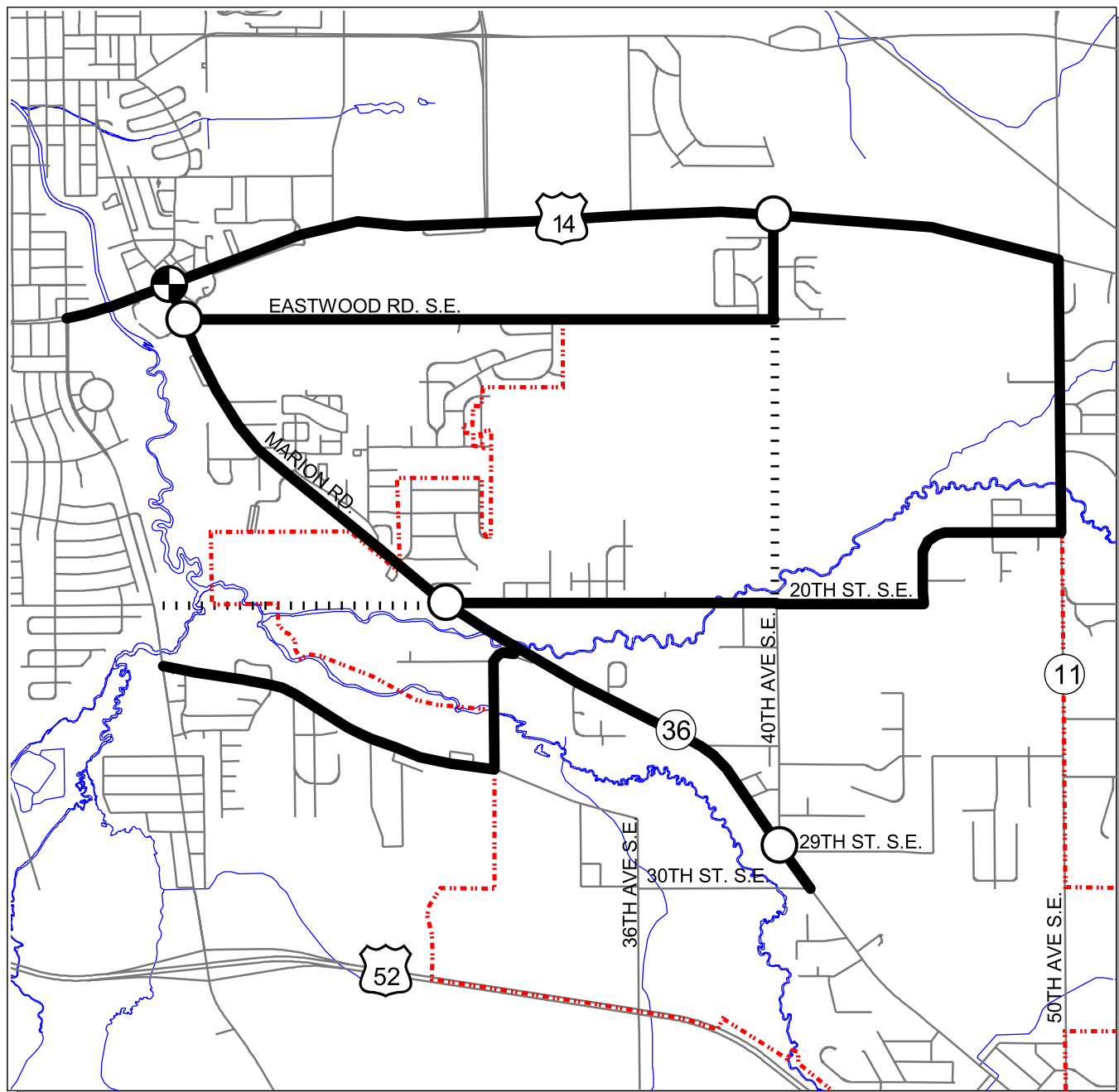
These intersections were selected because they provide the primary access to the regional road system. The vast majority of traffic exiting and entering the project area would have to use at least one of these intersections. The location of these five key intersections is shown in **Figure 2-1** and the existing lane geometry and traffic control for each intersection is shown in **Table 2-1**. It should be noted that the intersection of TH 14 and East Circle Drive (CSAH 22) was not analyzed here because it is currently being examined as part of another study.

2.2 Key Roadways Analyzed

The key roadways selected in southeast Rochester for analysis as part of this traffic study include:

1. TH 14 from 11th Ave (CSAH 1) to 50th Ave (CSAH 11)
2. Marion Road (CSAH 36) from TH 14 to 30th St
3. Eastwood Road (CR 144) from Marion Rd (CSAH 36) to 40th Ave
4. 20th Street (CR 143) from Marion Rd (CSAH 36) to 50th Ave (CSAH 11) – plus possible future connection from 11th Ave (CSAH 1) to Marion Rd (CSAH 36)
5. 40th Avenue from TH 14 to Eastwood Rd (CR 144) – plus possible future connection from Eastwood Rd (CR 144) to 20th St (CR 143)
6. Pinewood Road from 11th Ave (CSAH 1) to 30th Ave
7. 30th Avenue from Marion Rd (CSAH 36) to Pinewood Rd
8. 50th Avenue (CSAH 11) from TH 14 to CR 143 (N JCT)

The location of these roadways is shown on **Figure 2-1**. In Section 2.3 of this report, they are broken down into smaller segments to better reflect changes in traffic volumes. In general, the roadways were selected because they either are a part of the regional road system or they are a primary access to the regional road system. Specifically, TH 14 is an east-west roadway that is functional classified as a Principal Arterial. Principal Arterials emphasize mobility and are therefore designed to serve high speed, longer distance travel. From Marion Road to the east of 40th Avenue, TH 14 is a four-lane divided roadway with a rural design. Farther east of 40th Avenue, TH 14 becomes a two-lane undivided roadway with a rural design. The speed limit on TH 14 west of Marion Road is 40 miles-per-hour (mph). East of Marion Road, the speed limit is 55 mph. TH 14 is currently signalized at its intersections with Marion Road (CSAH 36), East Circle Drive (CSAH 22), and 50th Avenue SE (CSAH 11).



Legend

Informational Items

Existing Streets

Potential Roadway Connections

Water

AUAR Project Area



Existing Roadways Studied



Unsignalized Intersections

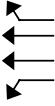
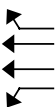
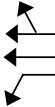

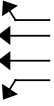
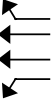
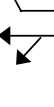
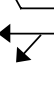


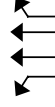

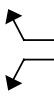
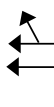


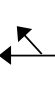
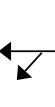


Signalized Intersections

0 0.5 1 1.5 2 Miles



Table 2-1
Existing Intersection Geometry and Traffic Control for Key Intersections
Marion Road AUAR

INTERSECTION	WEST APPROACH	EAST APPROACH	SOUTH APPROACH	NORTH APPROACH	TRAFFIC CONTROL	MAINLINE LEFT TURN PHASING	SIDE STREET LEFT TURN PHASING
TH 14							
Minor Street							
TH 14 / Marion Road					Signal	Exclusive	Split
TH 14 / 40th Avenue SE					Thru-STOP	n.a.	n.a.
Marion Road							
Minor Street							
Marion Road / Eastwood Road SE					Thru-STOP	n.a.	n.a.
Marion Road / 20th Street SE	n.a.				Thru-STOP	n.a.	n.a.
Marion Road / 40th Avenue SE	n.a.				Thru-STOP	n.a.	n.a.

NOTE: Thru-Stop indicates that the minor street approaches have a stop sign for oncoming vehicles but the major street approaches do not.

Marion Road (CSAH 36) runs mainly northwest-southeast through the project area. Between TH 14 and 40th Avenue, the roadway is functionally classified as a Minor Arterial. Minor Arterials interconnect with and augment Principal Arterials. They tend to provide slightly lower levels of mobility and slightly higher levels of land access than principal arterials. South of 40th Avenue, Marion Road is functionally classified as a Major Collector. Major Collectors provide both land access and local circulation within residential, commercial, and industrial areas.

From TH 14 to the Bear Creek Bridge, Marion Road is a five-lane undivided roadway with a continuous left turn lane. South of the bridge, Marion Road is a two-lane undivided roadway. The speed limit on Marion Road through the four-lane section is 40 mph. For the purposes of this report, Marion Road will be identified as a north-south roadway.

Eastwood Road (CR 144) is an east-west roadway that can currently be classified as a local roadway. Its primary function is to provide land access first and local circulation second. Between Marion Road and 40th Avenue, Eastwood Road is a two-lane undivided roadway with a rural design. The speed limit on Eastwood Road is 40 mph.

20th Street (CR 143) is an east-west roadway that is functionally classified as an Urban Collector. It is a two-lane undivided roadway with a rural design and the speed limit on 20th Street is 40 mph.

40th Avenue is a north-south roadway that that can be classified as a local roadway. It currently consists of two disconnected road segments; one segment is between TH 14 and Eastwood Road (CR 144) and one segment is between 20th Street and Marion Road. Along both sections, 40th Avenue is a two-lane undivided roadway with a rural design. The speed limit along these sections is 40 mph.

Pinewood Road is an east-west roadway that is functionally classified as an Urban Collector. It is a two-lane undivided roadway with a rural design and a speed limit between 11th Avenue and 30th Avenue of 35 mph. The section of 30th Avenue being studied is also a two-lane undivided roadway and its speed limit is not posted. However, the design of 30th Avenue would suggest its speed limit is no more than 35 mph. Unlike Pinewood Road, 30th Avenue is identified as a local roadway.

50th Avenue (CSAH 11) is a north-south roadway that is functionally classified as Major Collector. It is a two-lane undivided roadway with a rural design. From TH 14 to south of CR 143, its speed is 40 mph.

2.3 Existing Traffic Volumes

Intersection turning movement volumes were collected at the five key intersections during the AM and PM peak periods in July 2001. The AM and PM peak hours identified during those peak periods are 6:45 to 7:45 AM and 4:45 to 5:45 PM, respectively. **Table 2-2** displays the existing AM and PM peak hour turning movement volumes collected for each intersection. Average Daily Traffic (ADT) volumes were obtained from Year 1998 Mn/DOT Traffic Flow maps and supplemented with hourly tube count volumes collected during July 2001. On TH 14, the existing ADT volumes range from approximately 21,700 vehicles per day (vpd) west of Marion Road to 11,700 (vpd) east of 40th Avenue. On Marion Road, the ADT volumes range from approximately 15,900 vpd south of TH 14 to 4,400 vpd south of 40th Avenue. The ADT volumes for all of the key roadway segments are shown in **Figure 2-2**.

Table 2-2

Existing (2001) Turning Movement Volumes for Key Intersections

Marion Road AUAR

AM Peak Hour

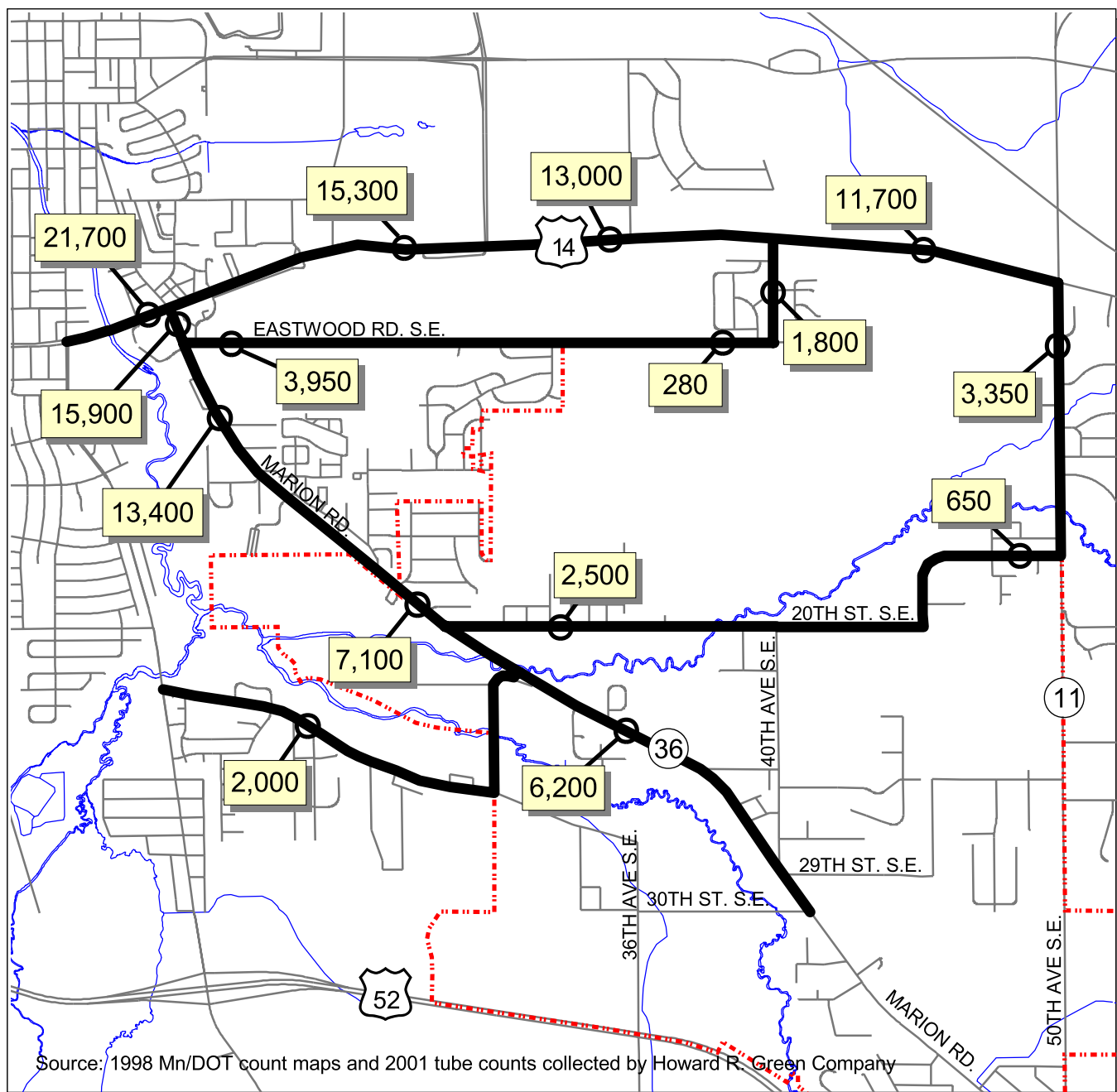
Location	West Approach			East Approach			South Approach			North Approach		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
TH 14												
Minor Street												
TH 14 / Marion Rd	138	366	143	44	473	138	250	292	79	31	124	110
TH 14 / 40th Ave SE	24	193	33	15	700	15	67	1	14	1	0	6
Marion Road												
Marion Rd / Eastwood Rd SE	28	11	22	4	7	62	25	468	20	65	178	2
Marion Rd / 20th St SE	0	0	0	7	0	41	0	528	5	8	108	0
Marion Rd / 40th Ave SE	0	0	0	11	0	6	0	173	5	0	56	0

PM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
TH 14												
Minor Street												
TH 14 / Marion Rd	221	715	384	117	468	86	306	261	78	183	369	240
TH 14 / 40th Ave SE	4	815	74	11	399	3	37	0	24	2	1	5
Marion Road												
Marion Rd / Eastwood Rd SE	19	6	55	46	2	141	24	364	22	135	547	26
Marion Rd / 20th St SE	0	0	0	11	0	25	0	220	10	32	352	0
Marion Rd / 40th St SE	0	0	0	19	0	3	0	124	21	3	231	0

Notes:

(1) Volumes were field collected by Howard R. Green in July, 2001



Legend

Informational Items

- Existing Streets
- Water
- AUAR Project Area
- Existing Roadways Studied

Existing Traffic Volumes

0 0.5 1 1.5 Miles



2.4 Existing Operations Analysis and Determination of Deficiencies

2.4.1 Analysis Methodology

In order to estimate the quality of traffic flow, or level of congestion on a roadway or at an intersection, traffic engineers utilize a recognized standard called “Level of Service” (LOS). The results of a LOS analysis are typically presented in the form of a letter grade (A through F). Much like an academic report card, LOS A represents conditions with “free-flow” traffic at higher speeds with little or no delays. Conversely, LOS F conditions are represented by considerable congestion with long delays and queuing. The LOS of an intersection or road segment is based on three main elements:

1. Roadway Geometry (i.e. How many lanes are there?)
2. Traffic Control (i.e. Is there a signal or stop sign?)
3. Traffic Volume (i.e. How many vehicles are using this intersection/road segment?)

Level of service at roadway intersections is defined in terms of the average control delay at the intersection in seconds per vehicle. The matrix below provides a range of average delay per vehicle for each level of service category. The threshold values for unsignalized intersections are slightly less than for signalized intersections because driver expectation of the intersection performance varies for different types of traffic control.

LOS	Signalized	Unsignalized
A	≤ 10 sec.	≤ 10 sec.
B	10 – 20 sec.	10 – 15 sec.
C	20 – 35 sec.	15 – 25 sec.
D	35 – 55 sec.	25 – 35 sec.
E	55 – 80 sec.	35 – 50 sec.
F	> 80 sec.	> 50 sec.

Source: Highway Capacity Manual (HCM) 2000, Tables 16-2 (Signalized) and 17-2 (Unsignalized)

The arterial roadway level of service was determined by conducting a planning level analysis. This analysis consists of comparing the peak hourly directional flow rates on a roadway segment to the LOS breakdown of peak hourly volumes for that facility type. **Figure 2-3** provides a breakdown of roadway LOS by peak hourly directional flow for the different facility types analyzed as part of this study. The figure was based on capacity information found in the Highway Capacity Manual (HCM) 2000.

It is important to understand that LOS is computed differently for intersections and road segments. This is because it is possible to have an uncongested intersection located along a congested roadway segment or, conversely, a congested intersection along an otherwise uncongested roadway.

Although LOS A conditions represent the best possible level of traffic flow, it is not feasible to build urban roadways and intersections to such high standards. Therefore, in the Rochester area, the Rochester-Olmsted County Council of Governments (ROCOG) has set the index of congestion for major urban roadways and intersections (such as Hwy 14 and Marion Rd) at the LOS C/D boundary while the congestion index for secondary roadways and intersections (such as 20th St SE and 40th Ave SE) is the LOS D/E boundary. This index indicates that LOS C conditions during the peak hour of traffic would be considered acceptable for major urban roadways and intersections, whereas LOS D conditions would be considered congested and deficient.

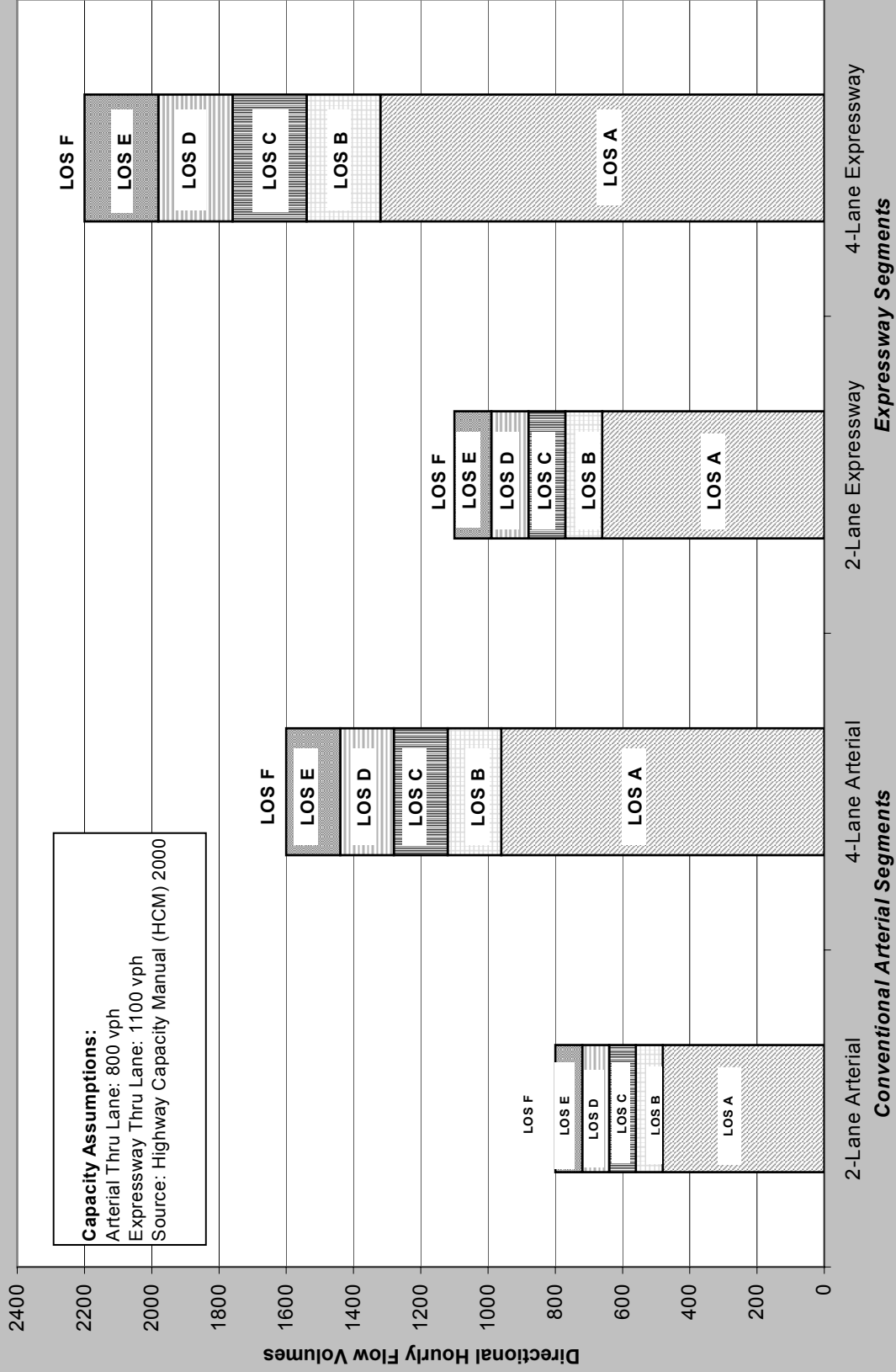


Figure 2-3
Estimated Segment Level of Service

Marion Road AUAR

Likewise, for secondary roadways and intersections, LOS D conditions during the peak hour of traffic would be considered acceptable whereas LOS E conditions would be considered congested and deficient. It should be noted that, for each individual movement at a specific intersection, the E/F boundary is always used as the indicator of congestion, regardless of the type of roadway. However, it should also be noted that LOS E is not desirable and intersections with individual movements at LOS E should be evaluated for potential improvements. The following is a summary of the index of congestion for the roadways and intersections analyzed as a part of this study:

- Primary Roadways and Intersections (TH 14 and Marion Road): LOS C/D boundary
- Secondary Roadways and Intersections (Eastwood Road, 40th Avenue, etc): LOS D/E boundary
- Individual Movements at all intersections: LOS E/F boundary

For the Marion Road intersections with TH 14 and Eastwood Road, a queuing analysis was completed in addition to the LOS analysis. The queuing analysis was completed because the close proximity of the two intersections indicated that traffic queues from the TH 14/Marion Road intersection could potentially extend into the Marion Road/Eastwood Road intersection. The results from a queuing analysis state whether the intersections being analyzed have adequate storage length with their existing lane geometry and whether traffic from one intersection is spilling back into the adjacent intersection. Traffic extending from one intersection into another is considered a deficiency in the roadway system.

2.4.2 Existing Level of Service and Queuing Analysis Results

Table 2-3 is a summary of existing AM and PM peak hour LOS for the five key intersections. During the AM hour, all intersections operate at a LOS C or better. During the PM peak hour, the TH 14/Marion Road intersection operates at LOS D. Also, the Marion Road/Eastwood Road intersection operates at LOS E due to the delays incurred on the west approach. In addition, the TH 14/40th Avenue intersection operates at LOS D during the PM peak hour but is not considered deficient because 40th Avenue is a secondary roadway. All other intersections operate at LOS B in the PM peak hour.

At the TH 14 / Marion Road intersection during the PM peak hour, the north approach through and left turn movements operate at LOS E. Visual observation of the north approach through movement during the PM peak hour revealed that the approach queue often extends beyond a private access to a nearby supermarket, conflicting with entry and exit into the site. Also, the south approach left turn operates at a LOS E. In addition, a queuing analysis revealed that the 95th percentile queues at the south approach left turn of this intersection extend beyond the left turn bay storage. The queues extend beyond the storage bay by approximately 100 feet and impact the adjacent through lane.

It should be noted that the initial LOS analysis results for the intersection of Marion Road and Eastwood Road indicated that vehicles turning left from Eastwood to southbound Marion Road were operating at LOS E. Because of the close proximity of the TH 14/Marion Road intersection to the Marion Road/Eastwood Road intersection, a more detailed micro-simulation analysis of the two intersections was completed to determine how each intersection impacts traffic operations at the other intersection. The micro-simulation analysis revealed that the traffic signal at the TH 14/Marion Road intersection provided gaps for vehicles to turn left from Eastwood Road to southbound Marion Road. However, the LOS for the intersection of Marion Road and Eastwood is still expected to LOS E due to the delays incurred by vehicles attempting to go through the intersection from the west approach. It should be noted that the west approach of the Marion Road/Eastwood Road intersection is a convenience store driveway and the total number of through movements is less than 10.

The existing LOS results for the TH 14/Marion Road intersection and the Marion Road/Eastwood Road intersection presented in **Table 2-3** were determined using micro-simulation analysis. The remaining three intersections were not analyzed via micro-simulation. This is because the distance between the other key intersections is large enough that the traffic operations at one intersection do not have a significant impact on the traffic operation at the other adjacent key intersections.

Table 2-3
Existing (2001) Level of Service for Key Intersections
Marion Road AUAR

AM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach			Intersection LOS (1)
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
	TH 14			Minor Street			Minor Street			Minor Street			
TH 14 / Marion Road ^(2,4)	C	B	A	C	C	A	C	C	B	C	C	A	B
TH 14 / 40th Avenue SE ⁽³⁾	A	n.a.	n.a.	A	n.a.	n.a.	C	C	C	B	B	B	C
	Minor Street			Minor Street			Marion Road			Marion Road			
Marion Road / Eastwood Road ^(3,4)	B	B	A	B	B	A	A	n.a.	n.a.	B	n.a.	n.a.	B
Marion Road / 20th Street SE ⁽³⁾	n.a.	n.a.	n.a.	B	n.a.	B	n.a.	n.a.	n.a.	A	n.a.	n.a.	B
Marion Road / 40th Avenue SE ⁽³⁾	n.a.	n.a.	n.a.	A	n.a.	A	n.a.	n.a.	n.a.	A	n.a.	n.a.	A

PM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach			Intersection LOS (1)
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
	TH 14			Minor Street			Minor Street			Minor Street			
TH 14 / Marion Road ^(2,4)	D	C	A	D	C	A	E	C	B	E	E	C	D
TH 14 / 40th Avenue SE ⁽³⁾	A	n.a.	n.a.	A	n.a.	n.a.	D	D	D	C	C	C	D
	Minor Street			Minor Street			Marion Road			Marion Road			
Marion Road / Eastwood Road ^(3,4)	D	E	A	C	n.a.	A	A	n.a.	n.a.	A	n.a.	n.a.	E ⁽⁵⁾
Marion Road / 20th Street SE ⁽³⁾	n.a.	n.a.	n.a.	B	n.a.	A	n.a.	n.a.	n.a.	A	n.a.	n.a.	B
Marion Road / 40th Avenue SE ⁽³⁾	n.a.	n.a.	n.a.	B	n.a.	B	n.a.	n.a.	n.a.	A	n.a.	n.a.	B

Notes:

General Note: Shaded results indicates LOS estimate exceeds ROCOG Index of Congestion.

(1) The intersection LOS reported for unsignalized intersections represents the worst movement level of service unless noted otherwise.

(2) Signalized Intersection

(3) Unsignalized Intersection

(4) LOS results from SimTraffic™

(5) Intersection not considered deficient because only one movement at LOS E and it is a convenience store driveway.

As mentioned, the TH 14/40th Avenue intersection operates at LOS D during the PM peak hour. This indicates that the small number of vehicles turning left or right from 40th Avenue to TH 14 are experiencing some delay in finding appropriate gaps in which to turn and is not considered to be a deficiency.

In order to determine the existing level of service for the key roadways in the project area, traffic count data collected during July 2001 in the project area first was examined. The traffic count data was examined to determine when the peak hour of daily traffic occurred, what percent of daily traffic occurred during the peak hour, and what the directional split of traffic was during the peak hour. This information was needed to convert the daily traffic counts of the key roadways into hourly directional lane volumes. The LOS for these roadways could then be calculated by comparing the volumes against the LOS bar charts found in **Figure 2-3**. An examination of the existing count data revealed the following information:

- PM Peak Hour: 4:45 PM – 5:45 PM
- Peak Hour Percentage of Daily Trips: 8%
- Directional Split of Traffic During PM Peak Hour: 60% / 40% (i.e. 60% of the two-way traffic will be traveling in one direction during the PM peak hour on the key roadways)

Table 2-4 summarizes the conversion of daily traffic into peak hour directional lane densities for the key roadways using the traffic characteristics obtained from the count data. The table also displays the LOS estimated for each segment by comparing the hourly directional volumes to the LOS bar charts in **Figure 2-3**. As can be seen in the table, many of the roadways have been divided into multiple segments. They were divided to better reflect changes in traffic volumes along each roadway through the project area. The table shows that all of the key roadways currently operate at LOS B or better.

2.4.3 Identification of Existing Deficiencies

The existing LOS deficiencies in the project area were identified by comparing the LOS results in Section 2.4.2 to the index of congestion established by ROCOG. The intersections of TH 14/Marion Road and Marion Road/Eastwood Road were also examined for queuing deficiencies. Intersection approaches were determined to have queuing deficiencies if traffic queues from one intersection extended into the adjacent intersections or blocked commercial driveways. The following deficiencies were identified:

- The TH 14/Marion Road intersection operates at LOS D in the PM peak hour.
- During the PM peak hour, queues from the north approach of the TH 14/Marion Road intersection were observed extending past a commercial access to a grocery store, effectively impeding access. Also, a queuing analysis revealed that vehicles turning left from the south approach during the PM peak hour will periodically exceed the available storage length and impact the adjacent through lane.

It should be noted that the north approach through and left turn movements along with the south approach left turn movements at the TH 14/Marion Road intersection operate at LOS E during the PM peak hour. While not deficient, LOS is not desirable and this intersection should be evaluated further to determine if operational improvements could be completed. Likewise, the Marion Road/Eastwood Road intersection is not deficient but the west approach is operating at LOS E. This intersection is not currently in need of further study because the west approach is a convenience store driveway with less than 10 vehicles using it as an intersection approach in the PM peak hour. These vehicles have the option to utilize another driveway to the north.

Table 2-4
Existing PM Peak Hour Segment Level of Service for Key Roadways
Marion Road AUAR

Segment	Start Point	End Point	Existing ADT	Roadway Classification	Roadway Section	Theoretical Peak Hour Density ⁽¹⁾ (pcphpl)	Actual Peak Hour Density ^{(2),(3)} (pcphpl)	LOS	% Reserve Roadway Capacity
TH 14	West of Marion Road	Marion Road	21,700	Rural Expressway	4-Lane	1400	520	A	63%
TH 14	Marion Road	East Circle Drive	15,300	Rural Expressway	4-Lane	1100	370	A	66%
TH 14	East Circle Drive	40th Avenue	13,000	Rural Expressway	4-Lane	1100	310	A	72%
TH 14	40th Avenue	East of 40th Avenue	11,700	Rural Expressway	2-Lane	900	560	B	38%
Marion Road	TH 14	Eastwood Road	15,900	Class I Arterial	4-Lane	800	380	A	53%
Marion Road	Eastwood Road	Sect S of Eastwood	13,400	Class I Arterial	4-Lane	800	320	A	60%
Marion Road	Sect N of 20th St	20th Street	7,100	Class I Arterial	4-Lane	800	170	A	79%
Marion Road	20th Street	40th Avenue	6,200	Class I Arterial	2-Lane	600	300	A	50%
Marion Road	40th Avenue	Sect S of 40th Ave	4,350	Class I Arterial	2-Lane	600	210	A	65%
Eastwood Rd	Marion Road	Sect E of Marion	3,950	Class II Arterial	2-Lane	600	190	A	68%
Eastwood Rd	Sect W of 40th Ave	40th Avenue	285	Class II Arterial	2-Lane	600	10	A	98%
20th Street	Marion Road	Sect E of Marion	2,500	Class II Arterial	2-Lane	600	120	A	80%
20th Street	Sect W of CSAH 11	CSAH 11	660	Class II Arterial	2-Lane	600	30	A	95%
40th Avenue	TH 14	Eastwood Road	1,800	Class II Arterial	2-Lane	600	90	A	85%
Pinewood Rd	11th Avenue	30th Avenue	2,000	Class II Arterial	2-Lane	600	100	A	83%
30th Avenue	Pinewood Road	Marion Road	NA	Class II Arterial	2-Lane	600	NA	NA	NA
50th Avenue	TH 14	Sect S of TH 14	3,350	Class II Arterial	2-Lane	600	160	A	73%

Notes:

(1) The theoretical peak hour density is different for different types of roadways.

(2) The existing PM peak hour density was calculated by applying a 8% peak hour factor (based on existing counts) to the ADT and then dividing by the total number of lanes.

(This methodology assumes a 60-40 split of traffic volumes in each direction of the roadway based on existing traffic counts)

(3) The volumes listed are peak hourly volumes by direction (pcphpl = passenger cars per hour per lane)

3.0 FUTURE CONDITIONS

For the purposes of completing the AUAR, a future land development scenario was established for the AUAR project area. The land development scenario was created to represent the highest intensity of land use expected in the project area at full build-out, which is estimated to occur by 2025. The purpose of this section of the traffic study is to identify the traffic impacts associated with this hypothetical development scenario. It should be noted that if future land development in the project area does not reach the level defined in the development scenario, expected traffic impacts might differ from what is presented. This could result in needing less mitigation to maintain acceptable operating conditions.

3.1 Year 2025 Land Development Scenario

The future land development expected to occur in the project area between now and 2025 is generalized as follows:

- 3,160 Single-Family Dwelling Units
- 3,140 Multi-Family Dwelling Units
- 180 Elderly/Senior Housing Dwelling Units
- 1,760 Square Feet of General Commercial Development
- 130,000 Square Feet of Neighborhood Commercial Development
- 579,500 Square Feet of Industrial Development
- 33 Acres of Undeveloped Parkland

In order to analyze the traffic impacts associated with this land development scenario, these land uses had to be distributed into a series of Traffic Analysis Zones (TAZ) covering the project area. A TAZ is a geographical area of similar types of land use developments that act as an origin or destination for vehicle trips. TAZ's were needed to organize land use information so that the information could be input into ROCOG's traffic forecasting model. ROCOG's traffic forecasting, or travel demand model, was used to develop future year traffic forecasts and is discussed later in this chapter.

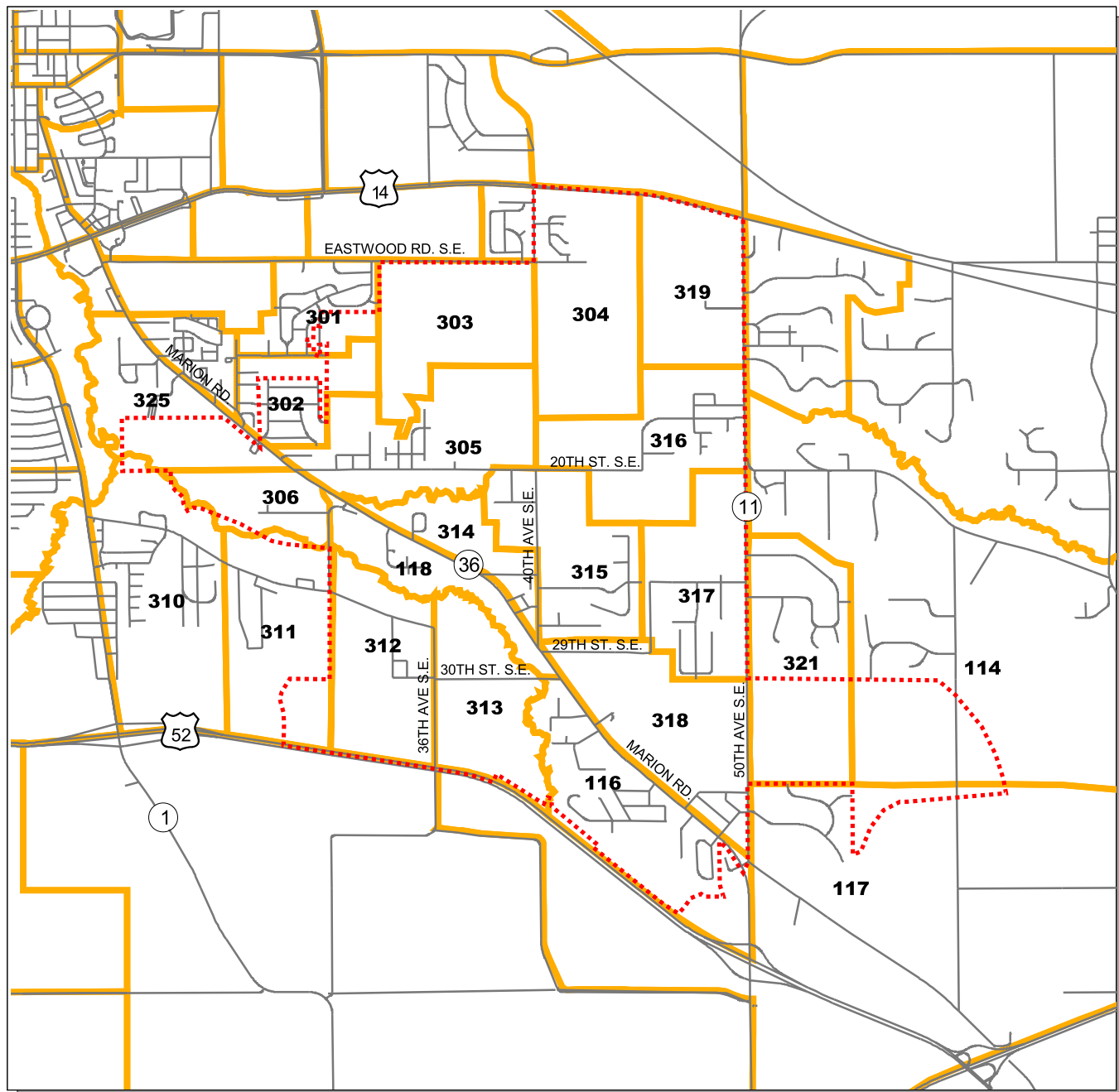
Table 3-1 provides a breakdown of the land uses summarized above by TAZ. **Figure 3-1** depicts the location of these TAZ's in the project area. The distribution to TAZ was completed through the joint efforts of ROCOG staff and the land use planning consultant HKGI. In general, the distribution of future project area land use to TAZ was completed by utilizing current comprehensive plans and zoning information while accounting for existing land uses and environmental constraints.

It should be noted that the 130,000 square feet of neighborhood commercial development projected to develop in the project area was not included in the TAZ distribution. This was because the unstable market forces that bring about this type of development make it exceedingly difficult to accurately predict at the TAZ level where this development would likely occur. In addition, it is expected that these neighborhood commercial trips would be diversions of trips already being generated by the households forecasted in the project area. Very few additional trips would be generated from these developments. As a result, traffic impacts related to these developments would be localized to the site itself and should be examined after a site location has been identified. Therefore, the traffic impacts associated with the expected neighborhood commercial development were not analyzed as part of this study.

Table 3-1
Distribution of Future Project Area Land Uses by TAZ

Marion Road AUAR

TAZ	LAND USE	QUANTITY	UNITS
114	Suburban Single-Family Residential	179	Dwelling Units
116	Suburban Multi-Family Residential	100	Dwelling Units
116	Suburban Single-Family Residential	101	Dwelling Units
117	Suburban Single-Family Residential	46	Dwelling Units
118	Suburban Multi-Family Residential	208	Dwelling Units
118	General Commercial	1.759	1000 SqFt (GFA)
118	Industrial	0.768	1000 SqFt (GFA)
301	Urban Multi-Family Residential	129	Dwelling Units
302	Urban Multi-Family Residential	152	Dwelling Units
303	Urban Single-Family Residential	631	Dwelling Units
303	Urban Multi-Family Residential	630	Dwelling Units
304	Suburban Single-Family Residential	446	Dwelling Units
304	Suburban Multi-Family Residential	146	Dwelling Units
305	Urban Single-Family Residential	201	Dwelling Units
305	Urban Multi-Family Residential	409	Dwelling Units
305	Industrial	0.678	1000 SqFt (GFA)
306	Urban Multi-Family Residential	89	Dwelling Units
310	Suburban Single-Family Residential	4	Dwelling Units
311	Suburban Single-Family Residential	103	Dwelling Units
311	Suburban Multi-Family Residential	34	Dwelling Units
312	Suburban Single-Family Residential	212	Dwelling Units
312	Suburban Multi-Family Residential	70	Dwelling Units
313	Suburban Single-Family Residential	361	Dwelling Units
313	Suburban Multi-Family Residential	216	Dwelling Units
314	Suburban Multi-Family Residential	90	Dwelling Units
314	Industrial	506.90	1000 SqFt (GFA)
315	Industrial	1.11	1000 SqFt (GFA)
315	Suburban Multi-Family Residential	89	Dwelling Units
315	Elderly/Senior Housing	88	Dwelling Units
316	Suburban Single-Family Residential	279	Dwelling Units
316	Suburban Multi-Family Residential	93	Dwelling Units
317	Suburban Single-Family Residential	92	Dwelling Units
317	Suburban Multi-Family Residential	92	Dwelling Units
317	Elderly/Senior Housing	92	Dwelling Units
318	Suburban Single-Family Residential	322	Dwelling Units
318	Suburban Multi-Family Residential	158	Dwelling Units
318	Industrial	70.13	1000 SqFt (GFA)
319	Suburban Single-Family Residential	86	Dwelling Units
319	Suburban Multi-Family Residential	174	Dwelling Units
321	Suburban Single-Family Residential	99	Dwelling Units
321	Suburban Multi-Family Residential	33	Dwelling Units
325	Urban Multi-Family Residential	226	Dwelling Units
325	Undeveloped Parkland	33.16	Acres



Legend

Informational Items

- Existing Streets
- AUAR Project Area
- Traffic Analysis Zone Boundary
- xxx Traffic Analysis Zone Number

0 0.5 1 1.5 2 Miles



3.2 Year 2025 Traffic Forecasts

Year 2025 traffic forecasts were initially developed for two scenarios, which includes:

- Year 2025 No-Development Scenario: Assumes that no new land development and no roadway improvements would be made in the project area between now and 2025.
- Year 2025 Development Scenario: Assumes the hypothetical land development scenario presented in Section 3.1 would be established in the project area by 2025. This scenario also assumes that a new (two-lane) 40th Avenue connection between Eastwood Road and 20th Street would be constructed in the study area.

A number of additional traffic forecasts were developed to analyze the impact of other potential roadway improvements in the study area. These forecasts were used to evaluate the effectiveness of the other potential improvements and mitigation measures and are discussed in more detail in the following sections of this report.

The new 40th Avenue connection between Eastwood Road and 20th Street was assumed to be built in the 2025 development scenario for two primary reasons. First, as land areas become more urban, a higher density of functionally classified roadways are needed to maintain an adequate level of access and mobility in the area. Typical standards indicate that in developing areas, Minor Arterials should be spaced at one to two-mile intervals with Major and Minor Collectors spaced at the half-mile or mile-point in-between. If the project area develops as proposed, additional functionally classified north-south roadways such as the proposed 40th Avenue connection will be needed in the study area to maintain adequate levels of mobility. The creation of a 40th Avenue connection would in some ways acts as a southerly extension of the East Circle Drive Beltway.

The second primary reason for assuming the completion of a 40th Avenue extension is if the land adjacent to the 40th Avenue corridor develops at the intensity proposed, it is likely that some sort of direct or in-direct connection between Eastwood Road and 20th Street will be necessary in order to provide a reasonable degree of circulation and access to the proposed development. Some level of road density will be needed to support the proposed intensity of development in the area. The 40th Avenue connection effectively acts as a proxy for that supporting road system.

The implication of these two reasons for assuming a 40th Street connection is that this connection would, to some degree, serve longer distance trips within the region while also providing some level of access to the adjacent development. The degree to which 40th Avenue provides mobility over access (i.e. Minor Arterial versus Major/Minor Collector) will depend on the future combination of roadways and development in the area. In this study, 40th Avenue was assumed to be a two-lane roadway between Eastwood Road and 20th Street.

Peak hour and ADT traffic forecasts for all scenarios were developed using the ROCOG Travel Demand Model. ROCOG staff provided year 2025 ADT model assignments for the forecast scenarios analyzed. These ADT model assignments were used to develop ADT forecasts for the key roadways. The ADT forecasts were developed by adjusting the model assignments as needed to account for the deviation between corresponding base year traffic counts and assignments.

The model assignments were also used to develop intersection turn movement forecasts. This was completed by using the model assignments to factor up existing turn movements to year 2025 or, for intersections where turning movement proportions are estimated to change dramatically in the future, the daily model assignments were adjusted down to reflect peak hour conditions.

It should be noted that vehicle trips such as those traveling to and from the project area were distributed between TAZ's using the gravity model. The gravity model determines the number of trips between TAZ's based on the number of trip ends (i.e. the origin or destination point of a trip) being generated out of each TAZ as well how close each TAZ is to every other TAZ. In short, the closer the two TAZ's are, the greater number of trips between them. Also, the greater number of trips in each pair of TAZ's, the greater number of trips between the TAZ's. Because of the numerous combinations of trips to, from, and within the project area, a summary of the distribution of project area trips would not be very useful and therefore has not been provided.

Vehicle trips in the project area were assigned to the model using an equilibrium assignment. An equilibrium assignment is a procedure where vehicle trips are iteratively assigned to the highway network until no vehicle trips can be assigned to an alternate path without increasing the total travel time of all trips in the network. This iterative procedure adjusts travel times between locations to account for travel delay related to roadway congestion.

3.2.1 Year 2025 No-Development Scenario

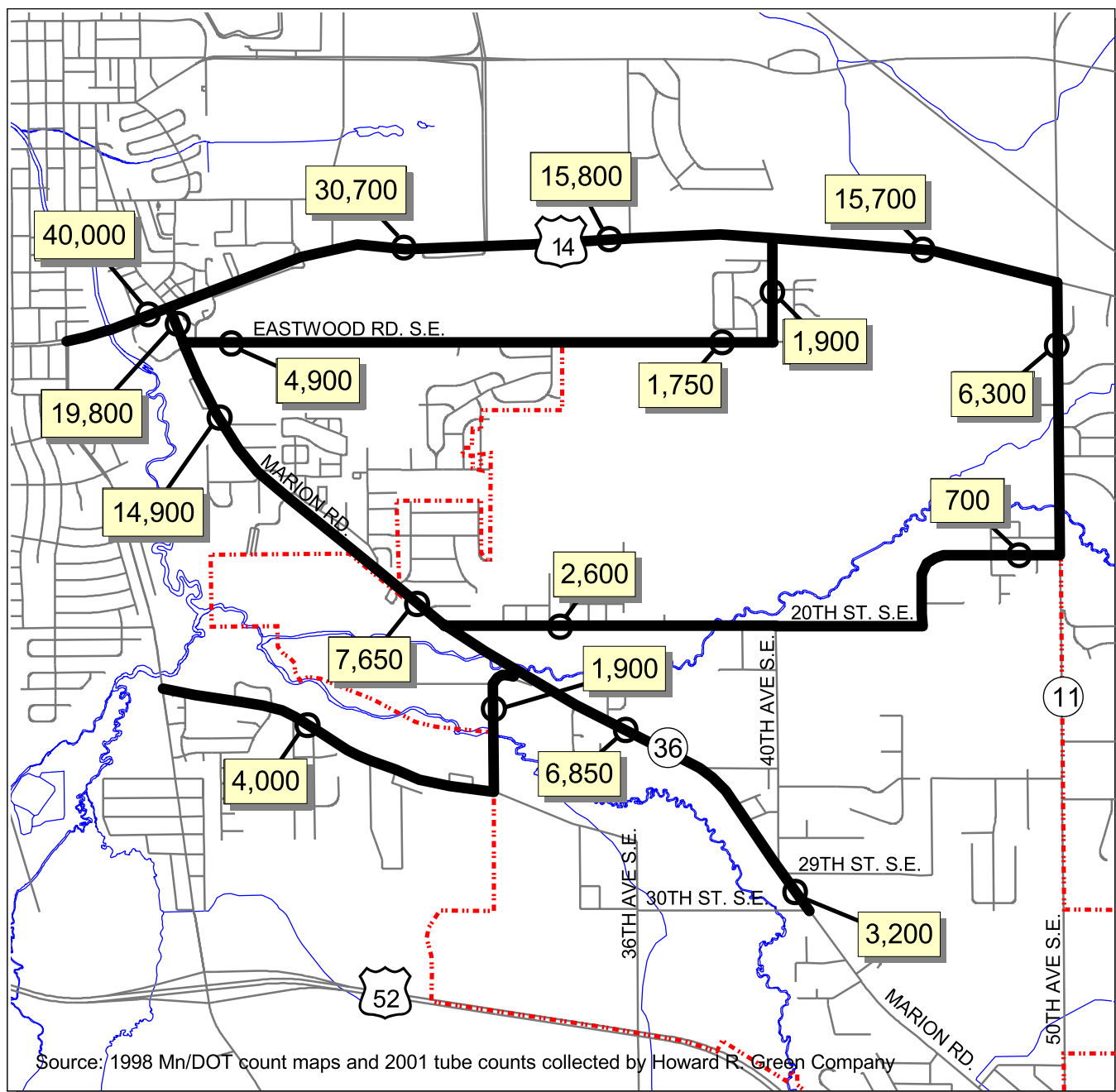
Traffic forecasts for a year 2025 no-development scenario were developed and analyzed to determine if there are traffic impacts associated with background traffic growth in the project area. Any impacts related to the background growth would be expected to occur even if no new land development occurs within the project area.

Using the methodology described earlier in this chapter, year 2025 ADT and peak hour traffic forecasts were developed. **Figure 3-2** displays the location of these forecasts. **Table 3-2** compares year 2025 no-build ADT's to existing ADT's. The table shows that traffic on TH 14 between Marion Road and East Circle Drive is forecasted to double even without any additional development in the project area. The absolute and percentage growth in background traffic on Marion Road and the other key roadways is somewhat less than what is forecasted on TH 14. However, background traffic on Pinewood Road and 50th Avenue is expected to double by 2025. The year 2025 peak-hour turn movements for the no-development scenario are presented in **Table 3-3**. The growth in the turn movements is reflective of the growth in the ADT volumes.

2025 No-Development LOS and Queuing Analysis Results – Without Improvements

The year 2025 no-development ADT and turn movements for the key roadways and intersections were analyzed using the LOS and queuing analysis methodology described in Section 2.4.1. **Table 3-4** presents the estimated LOS for the key roadways under the no-development scenario. The LOS estimates were developed assuming that no roadway improvements were completed in the corridor between now and 2025. The table shows that TH 14 east of 40th Avenue is expected to operate at LOS D. The remaining road segments are expected to operate at LOS B or better.

Table 3-5 displays the estimated LOS for the key intersections under the 2025 no-development Scenario. The LOS estimates were developed assuming that no intersection improvements were completed in the corridor between now and 2025 (see **Table 2-1** for geometry assumptions). The table shows that, during the PM peak hour, the TH 14/ Marion Road intersection operates at LOS F with several movements also at LOS F. In addition, the through movement for the west approach of the Marion Road/Eastwood Road intersection is expected to operate at LOS F during the PM peak hour. It should be noted that the west approach of the Marion Road/Eastwood Road intersection is a convenience store driveway and the total number of through movements forecast is less than 10.



Legend

Informational Items

- Existing Streets
- Water
- AUAR Project Area
- Existing Roadways Studied

1,000

2025 No-Development Scenario ADT Forecasts

0 0.5 1 1.5 Miles



Table 3-2
Year 2025 No-Development Average Daily Traffic (ADT) for Key Roadways
Marion Road AUAR

Segment	Start Point	End Point	Existing ADT	2025 No-Development ADT	Percent Increase in 2025 No-Build Traffic over Existing Traffic
TH 14	West of Marion Road	Marion Road	21,700	40,000	84%
TH 14	Marion Road	East Circle Drive	15,300	30,700	101%
TH 14	East Circle Drive	40th Avenue	13,000	15,800	22%
TH 14	40th Avenue	East of 40th Avenue	11,700	15,700	34%
Marion Road	TH 14	Eastwood Road	15,900	19,800	25%
Marion Road	Eastwood Road	Sect S of Eastwood	13,400	14,900	11%
Marion Road	Sect N of 20th St	20th Street	7,100	7,650	8%
Marion Road	20th Street	40th Avenue	6,200	6,850	10%
Marion Road	40th Avenue	Sect S of 40th Ave	NA	3,200	NA
Eastwood Rd	Marion Road	Sect E of Marion	3,950	4,900	24%
Eastwood Rd	Sect W of 40th Ave	40th Avenue	280	1,750	525%
20th Street	Marion Road	Sect E of Marion	2,500	2,600	4%
20th Street	Sect W of CSAH 11	CSAH 11	650	700	8%
40th Avenue	TH 14	Eastwood Road	1,800	1,900	6%
Pinewood Rd	11th Avenue	30th Avenue	2,000	4,000	100%
30th Avenue	Pinewood Road	Marion Road	NA	1,900	NA
50th Avenue	TH 14	Sect S of TH 14	3,350	6,300	88%

Table 3-3

2025 No-Development Turning Movement Volumes for Key Intersections

Marion Road AUAR

AM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
TH 14												
Minor Street												
TH 14 / Marion Rd	205	542	212	65	699	204	306	358	97	41	165	146
TH 14 / 40th Ave SE	69	446	75	20	914	20	84	2	17	4	2	49
Marion Road												
Marion Rd / Eastwood Rd SE	30	12	24	8	13	117	28	517	22	80	218	2
Marion Rd / 20th St SE	0	0	0	10	0	42	0	590	6	9	122	0
Marion Rd / 40th Ave SE	0	0	0	16	0	9	0	203	6	0	65	0

PM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
TH 14												
Minor Street												
TH 14 / Marion Rd	328	1060	569	195	779	143	375	320	96	244	491	320
TH 14 / 40th Ave SE	174	892	79	12	446	4	75	2	49	13	12	69
Marion Road												
Marion Rd / Eastwood Rd SE	21	7	60	87	4	265	27	402	24	165	670	32
Marion Rd / 20th St SE	0	0	0	16	0	25	0	246	11	35	398	0
Marion Rd / 40th St SE	0	0	0	27	0	4	0	146	25	4	303	0

Source: Howard R. Green Company and ROCOG Travel Demand Model

Table 3-4
2025 No-Development PM Peak Hour Segment Level of Service for Key Roadways
Marion Road AUAR

Segment	Start Point	End Point	Existing ADT	2025 No- Development ADT	Roadway Classification	Roadway Section	Theoretical Peak Hour Density ⁽¹⁾ (pcphpl)	Actual Peak Hour Density ^{(2),(3)} (pcphpl)	LOS
TH 14	West of Marion Road	Marion Road	21,700	40,000	Rural Expressway	4-Lane	1400	960	B
TH 14	Marion Road	East Circle Drive	15,300	30,700	Rural Expressway	4-Lane	1100	740	B
TH 14	East Circle Drive	40th Avenue	13,000	15,800	Rural Expressway	4-Lane	1100	380	A
TH 14	40th Avenue	East of 40th Avenue	11,700	15,700	Rural Expressway	2-Lane	900	750	D
Marion Road	TH 14	Eastwood Road	15,900	19,800	Class I Arterial	4-Lane	800	480	B
Marion Road	Eastwood Road	Sect S of Eastwood	13,400	14,900	Class I Arterial	4-Lane	800	360	A
Marion Road	Sect N of 20th St	20th Street	7,100	7,650	Class I Arterial	4-Lane	800	180	A
Marion Road	20th Street	40th Avenue	6,200	6,850	Class I Arterial	2-Lane	600	330	A
Marion Road	40th Avenue	Sect S of 40th Ave	NA	3,200	Class I Arterial	2-Lane	600	150	A
Eastwood Rd	Marion Road	Sect E of Marion	3,950	4,900	Class II Arterial	2-Lane	600	240	A
Eastwood Rd	Sect W of 40th Ave	40th Avenue	285	1,750	Class II Arterial	2-Lane	600	80	A
20th Street	Marion Road	Sect E of Marion	2,500	2,550	Class II Arterial	2-Lane	600	120	A
20th Street	Sect W of CSAH 11	CSAH 11	660	700	Class II Arterial	2-Lane	600	30	A
40th Avenue	TH 14	Eastwood Road	1,800	1,800	Class II Arterial	2-Lane	600	90	A
Pinewood Rd	11th Avenue	30th Avenue	2,000	4,000	Class II Arterial	2-Lane	600	190	A
30th Avenue	Pinewood Road	Marion Road	NA	1,900	Class II Arterial	2-Lane	600	90	A
50th Avenue	TH 14	Sect S of TH 14	3,350	6,300	Class II Arterial	2-Lane	600	300	A

Notes:

General Note: Shaded results indicates LOS estimate exceeds ROCOG Index of Congestion.

(1) The theoretical peak hour density is different for different types of roadways.

(2) The existing PM peak hour density was calculated by applying a 8% peak hour factor (based on existing counts) to the ADT and then dividing by the total number of lanes.

(This methodology assumes a 60-40 split of traffic volumes in each direction of the roadway based on existing traffic counts)

(3) The volumes listed are peak hour by direction (pcphpl = passenger cars per hour per lane)

Table 3-5
2025 No-Development Intersection Level of Service for Key Intersections
Marion Road AUAR

AM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach			Intersection LOS ⁽¹⁾
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
	TH 14						Minor Street						
TH 14 / Marion Road ^(2,4)	D	C	A	D	C	A	D	C	B	C	D	A	C
TH 14 / 40th Avenue SE ⁽³⁾	B	n.a.	n.a.	A	n.a.	n.a.	C	C	C	B	B	B	C
	Minor Street						Marion Road						
Marion Road / Eastwood Road ^(3,4)	B	B	A	C	C	A	A	n.a.	n.a.	A	n.a.	n.a.	C
Marion Road / 20th Street SE ⁽³⁾	n.a.	n.a.	n.a.	C	n.a.	B	n.a.	n.a.	n.a.	A	n.a.	n.a.	C
Marion Road / 40th Avenue SE ⁽³⁾	n.a.	n.a.	n.a.	B	n.a.	B	n.a.	n.a.	n.a.	A	n.a.	n.a.	B

PM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach			Intersection LOS ⁽¹⁾
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
	TH 14			Minor Street			Minor Street			Minor Street			
TH 14 / Marion Road ^(2,4)	F	F	F	F	D	A	F	D	C	F	F	F	F
TH 14 / 40th Avenue SE ⁽³⁾	A	n.a.	n.a.	A	n.a.	n.a.	D	D	D	C	C	C	D
	Minor Street			Minor Street			Marion Road			Marion Road			
Marion Road / Eastwood Road ^(3,4)	D	F	A	D	A	A	A	n.a.	n.a.	A	n.a.	n.a.	F
Marion Road / 20th Street SE ⁽³⁾	n.a.	n.a.	n.a.	B	n.a.	A	n.a.	n.a.	n.a.	A	n.a.	n.a.	B
Marion Road / 40th Avenue SE ⁽³⁾	n.a.	n.a.	n.a.	B	n.a.	B	n.a.	n.a.	n.a.	A	n.a.	n.a.	B

Notes:

General Note: Shaded results indicates LOS estimate exceeds ROCOG Index of Congestion.

(1) The intersection level of service reported for unsignalized intersections represents the worst movement level of service.

(2) Signalized Intersection

(3) Unsignalized Intersection

(4) LOS results from SimTraffic™

A queuing analysis was completed for the TH 14/Marion Road and Marion Road/Eastwood Road intersections. For the TH 14/Marion Road intersection, the queue lengths for the south and west approach left turn lanes are expected to extend beyond the available storage length and significantly impact the adjacent through lanes and spillback through upstream intersections. The analysis indicates that the queues from these approaches would extend into the TH 14/11th Avenue intersection and the Marion Road/Eastwood Road intersection, respectively, during the PM peak hour. Also, the queues on the north approach are expected to block driveways that access local businesses.

The LOS results for the key roadways and intersections were compared against the ROCOG's index of congestion given in Section 2.4.1. The key roadways and intersections determined to have LOS and queuing deficiencies under the 2025 no-development scenario are as follows:

LOS Deficient Roadways

- TH 14 east of 40th Avenue (expected to operate at a LOS D)

LOS Deficient Intersections

- TH 14/Marion Road Intersection (LOS F in PM Peak hour)
- Marion Road/Eastwood Road Intersection (Convenience Store Driveway through movement at LOS F in PM peak hour – LOS worsens with improvements to TH 14/Marion Rd intersection)

Intersections with Queuing Deficiencies

- During the PM peak hour, TH 14/Marion Road Intersection is estimated to create queues extending through the TH 14/11th Avenue intersection to the west and the Marion Road/Eastwood Road intersection to the south and also block access to local businesses on the north.

2025 No-Development LOS and Queuing Analysis Results – With Improvements

The purpose of this section is to identify what roadway and intersection-related improvements could be implemented to eliminate the project area roadway and intersection deficiencies for the 2025 no-development scenario. The different types of improvements examined include roadway reconstruction, altering traffic control, and optimizing the existing signal system. A number of different types of improvement strategies were iteratively examined in order to determine the best mix of improvements. Based on this process, the following improvements were identified:

1. Reconstruct the TH 14 / Marion Road intersection to accommodate dual left turns, two through lanes, and a right turn lane on all approaches.
2. Install a traffic signal at the Marion Road / Eastwood Road intersection.
3. Construct TH 14 as a four-lane expressway east of 40th Avenue through the 50th Avenue intersection. Improve the sight distance on TH 14 at the 40th Avenue intersection by reconstructing the vertical alignment on TH 14 to provide more gradual vertical grade changes near the 40th Avenue intersection.

Improving the TH 14/Marion Road and Marion Road/Eastwood Road intersections as described above eliminates the intersection operational deficiencies identified. Along with installing a traffic signal at the Marion Road/Eastwood Road intersection, the relocation of the Eastwood Road approach to approximately 600-700 feet south of its existing location should be considered even though it is not required. Doing so would enhance traffic operations and safety as discussed in the following paragraphs. **Table 3-6** displays the geometric and traffic control improvements assumed to alleviate these deficiencies. **Table 3-7** displays the resulting no-development intersection LOS resulting from these improvements. The table shows that the TH 14/Marion Road intersection is expected to operate at LOS C with these improvements in the PM peak hour.

TABLE 3-6

2025 No-Development Geometry and Traffic Control Improvements for Key Intersections
Marion Road AUAR

INTERSECTION	WEST APPROACH	EAST APPROACH	SOUTH APPROACH	NORTH APPROACH	TRAFFIC CONTROL	MAINLINE LEFT TURN PHASING	SIDE STREET LEFT TURN PHASING
TH 14							
Minor Street							
TH 14 / Marion Road					Signal	Exclusive	Exclusive
TH 14 / 40th Avenue SE					Thru-STOP	n.a.	n.a.
Marion Road							
Minor Street							
Marion Road / Eastwood Road SE					Signal	Exclusive / Permitted	Permitted
Marion Road / 20th Street SE	n.a.				Thru-STOP	n.a.	n.a.
Marion Road / 40th Avenue SE	n.a.				Thru-STOP	n.a.	n.a.

NOTE: Thru-Stop indicates that the minor street approaches have a stop sign for oncoming vehicles but the major street approaches do not.

- Indicates existing geometry

- Indicates roadway improvement

Table 3-7

2025 No-Development Intersection Level of Service with Improvements for Key Intersections

Marion Road AUAR

AM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach			Intersection LOS ⁽¹⁾
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
	TH 14			Minor Street			Minor Street			Minor Street			
TH 14 / Marion Road ^{(1),(3)}	C	B	A	C	B	A	C	C	A	C	C	A	B
TH 14 / 40th Avenue SE ⁽²⁾	B	n.a.	n.a.	A	n.a.	n.a.	C	C	C	B	B	B	C
	Minor Street			Marion Road			Marion Road			Marion Road			
Marion Road / Eastwood Road ^{(2),(3)}	B	B	A	C	C	A	A	n.a.	n.a.	A	n.a.	n.a.	C
Marion Road / 20th Street SE ⁽²⁾	n.a.	n.a.	n.a.	C	n.a.	B	n.a.	n.a.	n.a.	A	n.a.	n.a.	C
Marion Road / 40th Avenue SE ⁽²⁾	n.a.	n.a.	n.a.	B	n.a.	B	n.a.	n.a.	n.a.	A	n.a.	n.a.	B

PM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach			Intersection LOS ⁽¹⁾
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
	TH 14			Minor Street			Minor Street			Minor Street			
TH 14 / Marion Road ^{(1),(3)}	D	C	B	D	C	A	D	C	B	D	D	A	C
TH 14 / 40th Avenue SE ⁽²⁾	A	n.a.	n.a.	B	n.a.	n.a.	D	D	D	C	C	C	D
	Minor Street			Marion Road			Marion Road			Marion Road			
Marion Road / Eastwood Road ^{(3),(4)}	E/C	D/B	A/A	F/B	D/A	A/A	A/B	n.a./A	n.a./A	A/B	n.a./A	n.a./A	F/A
Marion Road / 20th Street SE ⁽²⁾	n.a.	n.a.	n.a.	B	n.a.	A	n.a.	n.a.	n.a.	A	n.a.	n.a.	B
Marion Road / 40th Avenue SE ⁽²⁾	n.a.	n.a.	n.a.	B	n.a.	B	n.a.	n.a.	n.a.	A	n.a.	n.a.	B

Notes:

General Note: The intersection level of service reported for unsignalized intersections represents the worst movement level of service.

(1) Signalized Intersection

(2) Unsignalized Intersection

(3) LOS results from SimTraffic™

(4) The first LOS estimate in each cell assumes unsignalized conditions, the second LOS estimate assumes signalized conditions.

In **Table 3-7**, two different LOS estimates are given for the Marion Road/Eastwood Road intersection during the PM peak hour. The first LOS estimate assumes an unsignalized condition and the second LOS estimate assumes a signalized condition. The unsignalized LOS was shown because the improvements made to the adjacent TH 14/Marion Road intersection changed the operations at the Marion Road/Eastwood Road intersection. The LOS for some approach movements improved while other movements worsened. Because minor street approach deficiencies were identified for the Marion Road/Eastwood Road intersection under improvement and no improvement conditions, an additional analysis was completed where the Marion Road/Eastwood Road intersection was assumed to be signalized. The second set of LOS estimates represent this condition. Under a signalized condition, this intersection is expected to operate at LOS A.

Mn/DOT has established recommended minimum signal spacing guidelines for different functionally classified roadways (see Section 4.2 for detailed discussion on signal spacing guidelines). For Marion Road (minor arterial), the recommended minimum spacing guideline is $\frac{1}{4}$ mile (1,320 feet). On Marion Road, the distance between TH 14 and Eastwood Road is approximately 800 feet. With the installation of a traffic signal at this location, the distance between the signalized intersections would be less than Mn/DOT's recommended minimum signal spacing guidelines of $\frac{1}{4}$ mile.

Also, human behavior studies have shown that the fewer events that a motorist is required to process the more likely it is that the motorist will successfully navigate through the roadway. Between intersections, there are three main areas of influence that affect drivers, which include:

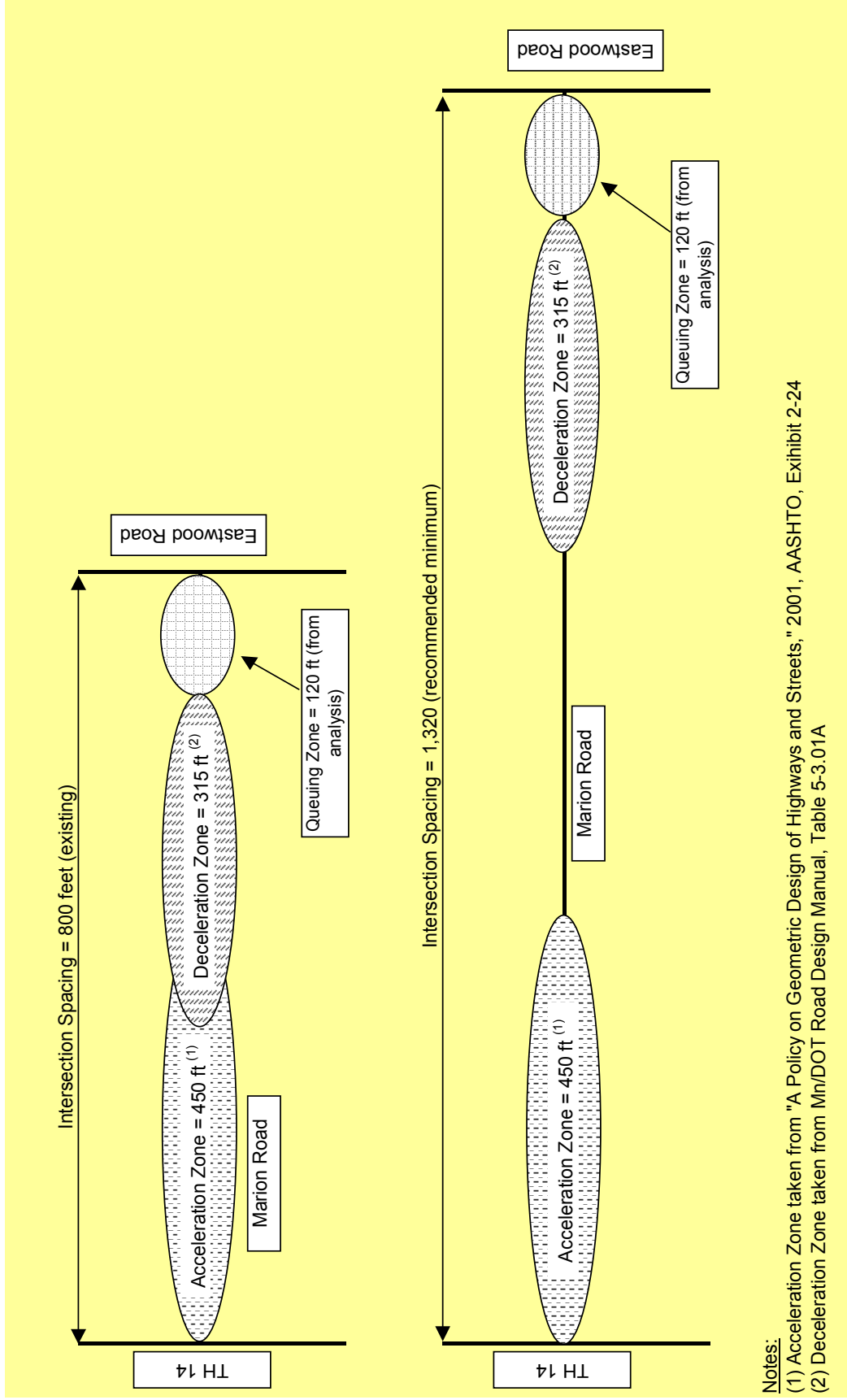
1. Acceleration Zone (includes perception and reaction time)
2. Deceleration Zone (includes perception and reaction time) and
3. Queuing Zone

If these influence zones overlap, the driver is now required to process more than one event at a time, which could lead to an increase in crashes at that specific location. **Figure 3-3** provides an illustration of acceleration zone, deceleration zone, and queuing zone for the installation of a signal at the Marion Road/Eastwood Road intersection with a spacing of 800 feet (existing) and a spacing of 1,320 feet (recommended minimum). The figure shows that for a signal spacing of 800 feet, the acceleration and deceleration zones would be expected to overlap. However, relocating the intersection to provide the recommended minimum spacing of 1,320 feet, the zones of influence would not be expected to overlap.

Therefore, a (not required) recommendation would be to relocate the Marion Road / Eastwood Road intersection approximately 600 feet to the south. By relocating the intersection, the distance between the TH 14 and Eastwood Road intersections would meet Mn/DOT recommended minimum spacing guidelines of $\frac{1}{4}$ mile (1,320 feet) and the zones of influence that affect drivers would not overlap. However, relocation of the signal would require additional right-of-way and potential property acquisitions.

Prior to installation of a traffic signal, a Signal Justification Report (SJR) should be completed by the appropriate roadway authority and include an analysis of the documented warrants for signalized intersections. The criteria for meeting these guidelines (eleven in all) are listed in the Minnesota Manual on Uniform Traffic Control Devices (MMUTCD). If any of the warrants are met, it suggests that traffic signals have been successfully installed under similar traffic volume conditions. However, even though an intersection meets these guidelines for the installation of a traffic signal, approval to install that signal is needed by the governing Agency that owns and maintains the roadway. An examination of the no-development scenario volumes at the Marion Road / Eastwood Road intersection indicate that the intersection exceeds the Peak Hour Volume Warrant (Warrant 11) thresholds for signalization during the PM hour. **Attachment A** is a summary graphic showing that Warrant 11 is met.

Figure 3-3
Intersection Spacing Areas of Influence
Marion Road AUAR



As a two-lane expressway, TH 14 east of 40th Avenue is forecast to operate at LOS D under the 2025 no-development scenario. According to ROCOG's index of congestion, this is considered deficient. If this segment were constructed as a four-lane divided expressway, the theoretical capacity of the roadway would increase to approximately 1,110 vehicles per hour per lane and the roadway would be expected to operate at a LOS B. Mn/DOT is in the early stages of examining the feasibility of converting TH 14 to a four-lane expressway between 40th Avenue and Eyota, Minnesota to the east.

3.2.2 Year 2025 Development Scenario

In order to estimate the traffic impacts associated with the land development scenario, trip ends need to be estimated for each TAZ from the land uses shown in **Table 3-1**. Trip ends are the origin point or destination point of a trip and **Table 3-8** displays the development land uses along with trip end generation totals for each land use. Trip ends were generated using the trip generation equations from the ROCOG travel demand model. These trip ends were input into the model so they could be distributed and assigned to the model network as discussed earlier in this section. The table shows that approximately 59,100 total new daily trip ends are generated from the land use scenario.

Traffic forecasts for the year 2025 development scenario were developed using the methodology described earlier in this chapter. The resulting forecasts were then analyzed to determine if there are traffic impacts associated with 2025 development in the project area. It should be noted that, as a part of this scenario, a new 40th Avenue connection between Eastwood Road and 20th Street was assumed to be built. The rationale for the 40th Avenue connection is provided earlier in this chapter.

Figure 3-4 displays the location of the development scenario ADT forecasts. **Table 3-9** compares year 2025 development ADT's to no-development ADT's and existing ADT's. As expected, the table shows an increase in ADT volumes, particularly for Marion Road and 40th Avenue.

Table 3-10 displays the peak hour turn movements for the development scenario. The growth in the turn movements is reflective of the growth in the ADT volumes. The growth in vehicle trips is especially significant for the south approach of the TH 14/40th Avenue intersection.

2025 Development LOS and Queuing Analysis Results – Without Improvements and Mitigations

The year 2025 Development ADT and turn movements for the key roadways and intersections were analyzed using the LOS and queuing analysis methodology described in Section 2.4.1. **Table 3-11** presents the estimated LOS for the key roadways under the development scenario. The table shows the following:

- TH 14 east of 40th Avenue (expected to operate at a LOS D – same as no-development)
- Marion Road between TH 14 and Eastwood Road (expected to operate at a LOS E)
- Marion Road between 20th Street and 40th Avenue (expected to operate at a LOS E)

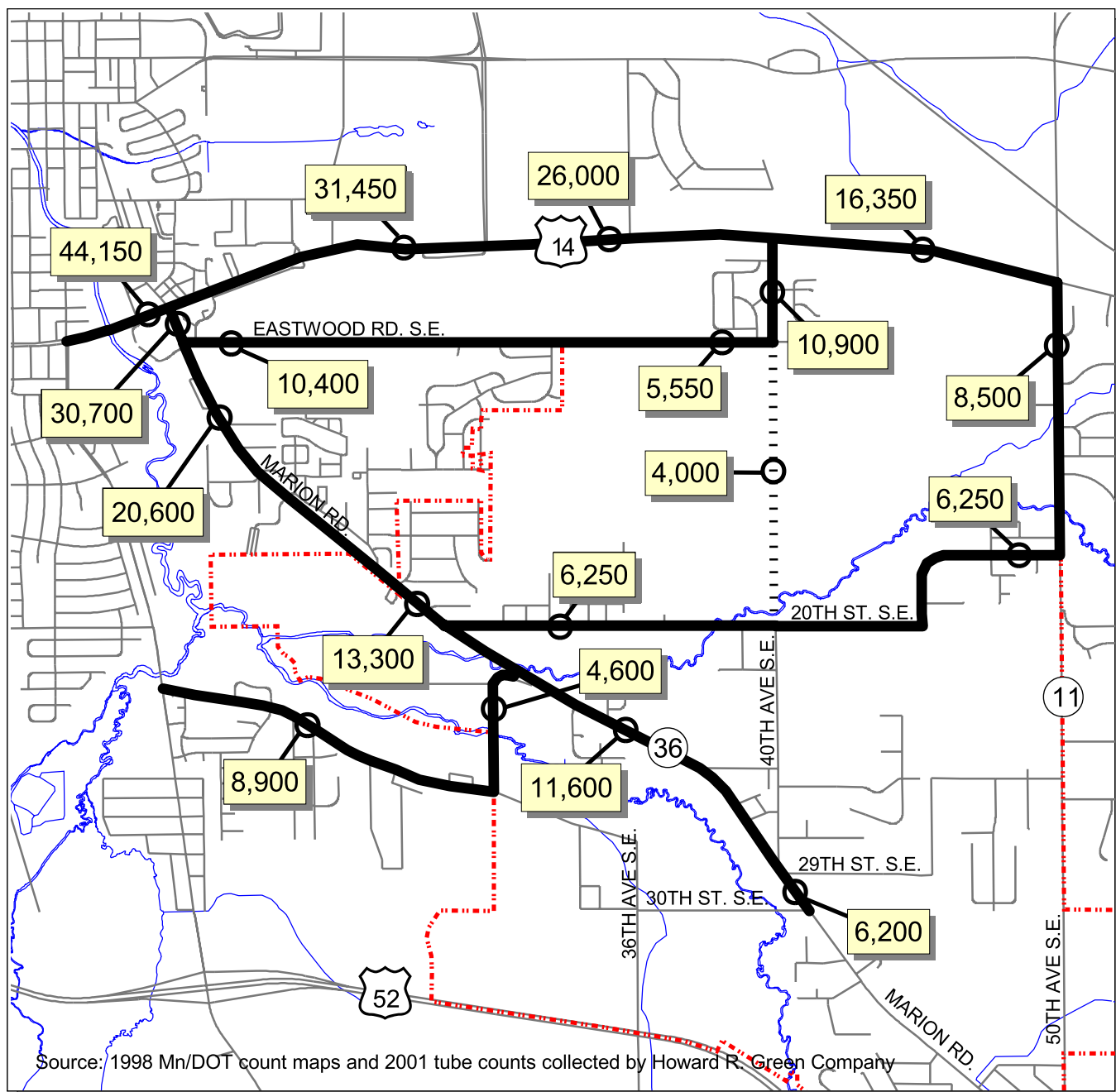
Eastwood Road east of Marion Road and 40th Avenue between TH 14 and Eastwood Road are expected to operate at a LOS D. However, these roadways are classified as secondary roadways. The ROCOG index of congestion for secondary roadways is the LOS D/E boundary. Therefore, these two roadways are expected to operate at acceptable levels. All other roadway segments are expected to operate at a LOS C or better under the development scenario.

The results of the intersection LOS analysis for the Year 2025 development scenario are presented in **Table 3-12**. The results of the AM peak hour intersection LOS analysis reveals that the minor street movements at the thru-STOP intersections of TH 14 / 40th Avenue and Marion Road / Eastwood Road are expected to operate at a LOS F. Also, the signalized intersection of TH 14 / Marion Road is expected to operate at a LOS F primarily due to the failure of the south approach left turns.

Table 3-8
Trip Generation by TAZ
Marion Road AUAR

TAZ	LAND USE	QUANTITY	UNITS	DAILY TRIP END RATES	DAILY TRIP ENDS
114	Suburban Single-Family Residential	179	Dwelling Units	11.38	2037
116	Suburban Multi-Family Residential	100	Dwelling Units	6.53	653
116	Suburban Single-Family Residential	101	Dwelling Units	11.38	1149
117	Suburban Single-Family Residential	46	Dwelling Units	11.38	524
118	Suburban Multi-Family Residential	208	Dwelling Units	6.53	1358
118	General Commerical	1.759	1000 SqFt (GFA)	40.00	70
118	Industrial	0.768	1000 SqFt (GFA)	5.50	4
301	Urban Multi-Family Residential	129	Dwelling Units	6.50	839
302	Urban Multi-Family Residential	152	Dwelling Units	6.50	988
303	Urban Single-Family Residential	631	Dwelling Units	9.97	6291
303	Urban Multi-Family Residential	630	Dwelling Units	6.50	4095
304	Suburban Single-Family Residential	446	Dwelling Units	11.38	5076
304	Suburban Multi-Family Residential	146	Dwelling Units	6.53	953
305	Urban Single-Family Residential	201	Dwelling Units	9.97	2004
305	Urban Multi-Family Residential	409	Dwelling Units	6.50	2659
305	Industrial	0.678	1000 SqFt (GFA)	5.50	4
306	Urban Multi-Family Residential	89	Dwelling Units	6.50	579
310	Suburban Single-Family Residential	4	Dwelling Units	11.38	46
311	Suburban Single-Family Residential	103	Dwelling Units	11.38	1172
311	Suburban Multi-Family Residential	34	Dwelling Units	6.53	222
312	Suburban Single-Family Residential	212	Dwelling Units	11.38	2413
312	Suburban Multi-Family Residential	70	Dwelling Units	6.53	457
313	Suburban Single-Family Residential	361	Dwelling Units	11.38	4109
313	Suburban Multi-Family Residential	216	Dwelling Units	6.53	1410
314	Suburban Multi-Family Residential	90	Dwelling Units	6.53	588
314	Industrial	506.90	1000 SqFt (GFA)	5.50	2788
315	Industrial	1.11	1000 SqFt (GFA)	5.50	6
315	Suburban Multi-Family Residential	89	Dwelling Units	6.53	581
315	Elderly/Senior Housing	88	Dwelling Units	2.60	229
316	Suburban Single-Family Residential	279	Dwelling Units	11.38	3175
316	Suburban Multi-Family Residential	93	Dwelling Units	6.53	607
317	Suburban Single-Family Residential	92	Dwelling Units	11.38	1047
317	Suburban Multi-Family Residential	92	Dwelling Units	6.53	601
317	Elderly/Senior Housing	92	Dwelling Units	2.60	239
318	Suburban Single-Family Residential	322	Dwelling Units	11.38	3665
318	Suburban Multi-Family Residential	158	Dwelling Units	6.53	1032
318	Industrial	70.13	1000 SqFt (GFA)	5.50	386
319	Suburban Single-Family Residential	86	Dwelling Units	11.38	979
319	Suburban Multi-Family Residential	174	Dwelling Units	6.53	1136
321	Suburban Single-Family Residential	99	Dwelling Units	11.38	1127
321	Suburban Multi-Family Residential	33	Dwelling Units	6.53	215
325	Urban Multi-Family Residential	226	Dwelling Units	6.50	1469
325	Undeveloped Parkland	33.16	Acres	4.00	133
GRAND TOTAL OF TRIP ENDS:					59,115

Source: ROCOG, HKGI, and Howard R Green Company



Legend

Informational Items

- Existing Streets
- Water
- AUAR Project Area
- Potential Roadway Connections
- Existing Roadways Studied
- 2025 Development ADT Forecasts

0 0.5 1 1.5 Miles



Figure 3-4
2025 Development Scenario
ADT Forecasts

Table 3-9

Year 2025 Average Daily Traffic (ADT) for Key Roadways - Development and No Development Scenarios

Marion Road AUAR

Segment	Start Point	End Point	Existing ADT	2025 No- Development ADT	2025 Development ADT	Percent Increase in 2025 Development ADT over Existing ADT
TH 14	West of Marion Road	Marion Road	21,700	40,000	44,150	103%
TH 14	Marion Road	East Circle Drive	15,300	30,700	31,450	106%
TH 14	East Circle Drive	40th Avenue	13,000	15,800	26,000	100%
TH 14	40th Avenue	East of 40th Avenue	11,700	15,700	16,350	40%
Marion Road	TH 14	Eastwood Road	15,900	19,800	30,700	93%
Marion Road	Eastwood Road	Sect S of Eastwood	13,400	14,900	20,600	54%
Marion Road	Sect N of 20th St	20th Street	7,100	7,650	13,300	87%
Marion Road	20th Street	40th Avenue	6,200	6,850	11,600	87%
Marion Road	40th Avenue	Sect S of 40th Ave	NA	3,200	6,200	NA
Eastwood Rd	Marion Road	Sect E of Marion	3,950	4,900	10,400	163%
Eastwood Rd	Sect W of 40th Ave	40th Avenue	285	1,750	5,550	1847%
20th Street	Marion Road	Sect E of Marion	2,500	2,600	6,250	150%
20th Street	Sect W of CSAH 11	CSAH 11	660	700	3,350	408%
40th Avenue	TH 14	Eastwood Road	1,800	1,900	10,900	506%
40th Avenue	Eastwood Road	20th Street	NA	NA	4,000	NA
Pinewood Rd	11th Avenue	30th Avenue	2,000	4,000	8,900	345%
30th Avenue	Pinewood Road	Marion Road	NA	1,900	4,600	NA
50th Avenue	TH 14	Sect S of TH 14	3,350	6,300	8,500	154%

Table 3-10

2025 Development Turning Movement Volumes for Key Intersections

Marion Road AUAR

AM Peak Hour												
Location	West Approach			East Approach			South Approach			North Approach		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
TH 14												
Minor Street												
TH 14 / Marion Rd	219	580	227	69	740	216	457	534	144	56	223	198
TH 14 / 40th Ave SE	52	452	514	41	885	12	372	52	21	5	35	160
Marion Road												
Minor Street												
Marion Rd / Eastwood Rd SE	31	12	24	15	26	229	37	688	29	119	326	4
Marion Rd / 20th St SE	0	0	0	35	0	102	0	800	22	20	202	0
Marion Rd / 40th Ave SE	0	0	0	25	0	13	0	407	12	0	88	0
PM Peak Hour												
Location	West Approach			East Approach			South Approach			North Approach		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
TH 14												
Minor Street												
TH 14 / Marion Rd	360	1165	626	199	797	146	575	490	146	315	635	413
TH 14 / 40th Ave SE	160	885	372	21	452	5	514	35	41	12	52	52
Marion Road												
Minor Street												
Marion Rd / Eastwood Rd SE	21	7	60	178	8	546	37	555	34	254	1027	49
Marion Rd / 20th St SE	0	0	0	54	0	62	0	404	45	79	659	0
Marion Rd / 40th St SE	0	0	0	218	0	34	0	274	46	5	394	0

Notes:

Source: Howard R. Green Company and ROCOG Travel Demand Model.

Table 3-11
2025 Development PM Peak Hour Segment Level of Service for Key Intersections
Marion Road AUAR

Segment	Start Point	End Point	Existing ADT	2025 Development ADT	Roadway Classification	Roadway Section	Theoretical Peak Hour Density ⁽¹⁾ (pcphpl)	Actual Peak Hour Density ^{(2),(3)} (pcphpl)	LOS	% Reserve Roadway Capacity
TH 14	West of Marion Road	Marion Road	21,700	44,150	Rural Expressway	4-Lane	1400	1060		
TH 14	Marion Road	East Circle Drive	31,450	31,450	Rural Expressway	4-Lane	1100	750	C	24%
TH 14	East Circle Drive	40th Avenue	13,000	26,000	Rural Expressway	4-Lane	1100	620	B	32%
TH 14	40th Avenue	East of 40th Avenue	11,700	16,350	Rural Expressway	2-Lane	900	780	A	44%
Marion Road	TH 14	Eastwood Road	15,900	30,700	Class I Arterial	4-Lane	800	740	D	13%
Marion Road	Eastwood Road	Sect S of Eastwood	13,400	20,600	Class I Arterial	4-Lane	800	490	E	8%
Marion Road	Sect N of 20th St	20th Street	7,100	13,300	Class I Arterial	4-Lane	800	320	B	39%
Marion Road	20th Street	40th Avenue	6,200	11,600	Class I Arterial	2-Lane	600	560	A	60%
Marion Road	40th Avenue	Sect S of 40th Ave	NA	6,200	Class I Arterial	2-Lane	600	300	E	7%
Eastwood Rd	Marion Road	Sect E of Marion	3,950	10,400	Class II Arterial	2-Lane	600	500	A	50%
Eastwood Rd	Sect W of 40th Ave	40th Avenue	285	5,550	Class II Arterial	2-Lane	600	270	D	17%
20th Street	Marion Road	Sect E of Marion	2,500	6,250	Class II Arterial	2-Lane	600	300	A	55%
20th Street	Sect W of CSAH 11	CSAH 11	660	3,350	Class II Arterial	2-Lane	600	160	A	50%
40th Avenue	Eastwood Road	20th Street	NA	4,000	Class II Arterial	2-Lane	600	190	A	73%
40th Avenue	TH 14	Eastwood Road	1,800	10,900	Class II Arterial	2-Lane	600	520	A	68%
Pinewood Rd	11th Avenue	30th Avenue	2,000	8,900	Class II Arterial	2-Lane	600	430	D	13%
30th Avenue	Pinewood Road	Marion Road	NA	4,600	Class II Arterial	2-Lane	600	220	C	28%
50th Avenue	TH 14	Sect S of TH 14	3,350	8,500	Class II Arterial	2-Lane	600	410	A	63%
									B	32%

Notes:

General Note: Shaded results indicates LOS estimate exceeds ROCOG Index of Congestion.

(1) The theoretical peak hour density is different for different types of roadways.

(2) The existing PM peak hour density was calculated by applying a 8% peak hour factor (based on existing counts) to the ADT and then dividing by the total number of lanes.

(3) This methodology assumes a 60-40 split of traffic volumes in each direction of the roadway based on existing traffic counts

(The volumes listed are peak hourly volumes by direction (pcphpl = passenger cars per hour per lane)

Table 3-12

2025 Development Intersection Level of Service for Key Intersections

Marion Road AUAR

AM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach			Intersection LOS ⁽¹⁾
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
	TH 14			Minor Street			Minor Street			Marion Road			
TH 14 / Marion Road ^(2,4)	D	C	A	D	C	A	F	F	F	D	D	A	F
TH 14 / 40th Avenue SE ⁽³⁾	B	n.a.	n.a.	A	n.a.	n.a.	F	F	F	F	F	F	F
	Minor Street			Minor Street			Marion Road						
Marion Road / Eastwood Road ^(3,4)	D	D	A	F	F	C	A	n.a.	n.a.	C	n.a.	n.a.	F
Marion Road / 20th Street SE ⁽³⁾	n.a.	n.a.	n.a.	D	n.a.	B	n.a.	n.a.	n.a.	A	n.a.	n.a.	D
Marion Road / 40th Avenue SE ⁽³⁾	n.a.	n.a.	n.a.	B	n.a.	B	n.a.	n.a.	n.a.	A	n.a.	n.a.	B

PM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach			Intersection LOS ⁽¹⁾
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
	TH 14			Minor Street			Marion Road			Minor Street			
TH 14 / Marion Road ^(2,4)	F	F	F	F	D	A	F	F	F	F	F	F	F
TH 14 / 40th Avenue SE ⁽³⁾	A	n.a.	n.a.	A	n.a.	n.a.	F	F	F	F	F	F	F
Marion Road / Eastwood Road ^(3,4)	F	F	F	F	F	F	A	n.a.	n.a.	C	n.a.	n.a.	F
Marion Road / 20th Street SE ⁽³⁾	n.a.	n.a.	n.a.	D	n.a.	B	n.a.	n.a.	n.a.	A	n.a.	n.a.	D
Marion Road / 40th Avenue SE ⁽³⁾	n.a.	n.a.	n.a.	D	n.a.	D	n.a.	n.a.	n.a.	A	n.a.	n.a.	D

Notes:

General Note: Shaded results indicates LOS estimate exceeds ROCOG Index of Congestion.

(1) The intersection level of service reported for unsignalized intersections represents the worst movement level of service.

(2) Signalized Intersection

(3) Unsignalized Intersection

(4) LOS results from Sim Traffic™

The results of the PM peak hour intersection LOS indicate that the minor street movements at the thru-STOP intersections of TH 14 / 40th Avenue and Marion Road / Eastwood Road are expected to operate at a LOS F, which was similar to the AM peak hour. Also, the signalized intersection of TH 14 / Marion Road is expected to operate at a LOS F with several movements operating at a LOS F.

Because the minor street approaches at the TH 14 / 40th Avenue and Marion Road / Eastwood Road intersections are expected to experience significant delays during the AM and PM peak hours, the queues on these approaches are expected to be extremely long. Also, for the TH 14/Marion Road intersection, the queue lengths for the south and west approach left turn lanes are expected to extend beyond the available storage length and significantly impact the adjacent through lanes. The analysis indicates that the queues from these approaches would extend through the TH 14/11th Avenue intersection and the Marion Road/Eastwood Road intersection during the AM and PM peak hours. Also, the queues on the north approach are expected to block driveways that provide access to/from the local businesses.

The LOS results for the key roadways and intersections were compared against the ROCOG's index of congestion given in Section 2.4.1. The key roadways and intersections determined to have LOS and queuing deficiencies under the 2025 development scenario are as follows:

LOS Deficient Roadways

- TH 14 east of 40th Avenue (expected to operate at a LOS D)
- Marion Road between TH 14 and Eastwood Road (expected to operate at a LOS E)
- Marion Road between 20th Street and 40th Avenue (expected to operate at a LOS E)

LOS Deficient Intersections

- TH 14/Marion Road Intersection (LOS F in AM and PM peak hour)
- Marion Road/Eastwood Road Intersection (LOS F in AM and PM peak hour)
- TH 14/40th Avenue Intersection (LOS F in AM and PM peak hour)

Intersections with Queuing Deficiencies

- During the PM peak hour, TH 14/Marion Road Intersection is estimated to create queues extending through the TH 14/11th Avenue intersection to the west and the Marion Road/Eastwood Road intersection to the south. Also, the queues on the north approach are expected to block access to local businesses.

2025 Development LOS and Queuing Analysis Results – With Improvements and Mitigations

The purpose of this section is to identify what roadway and intersection-related improvements and mitigations could be implemented to eliminate the project area roadway and intersection deficiencies for the 2025 development scenario. For the purposes of this report, “improvements” are defined as roadway enhancements needed to eliminate deficiencies that are expected to occur under the 2025 no-development scenario. “Mitigations” are defined as roadway enhancements that are needed to eliminate the additional 2025 deficiencies that are associated solely with the development scenario.

The implication of the above definitions is that improvements would be necessary by 2025 even if the project area does not develop. It will be necessary to implement mitigations, on the other hand, incrementally as future development occurs in the project area. It should be noted that the development scenario identified here is a hypothetical “worst-case” scenario. The timing and intensity of additional development in the project area will dictate when, where, and what roadway enhancements are needed. It should also be noted that the improvements and mitigations identified in this traffic study affect roadways maintained by different jurisdictions such as the state, county, City of Rochester, and Marion Township. Therefore, improvements and mitigations identified on state and county roadways will require state and county involvement.

The different types of improvements and mitigations examined include existing roadway reconstruction, new roadway construction, altering traffic control, and optimizing the existing traffic signal system. A number of different types of improvement and mitigation strategies were iteratively examined in order to determine the best mix of enhancements. Based on this process, the following improvements and mitigations were identified:

Roadway and Intersection Improvements

(Improvements are enhancements recommended under the 2025 no-development scenario)

1. Reconstruct the TH 14 / Marion Road intersection to accommodate dual left turns, two through lanes, and a right turn lane on all approaches.
2. Install a traffic signal at the Marion Road / Eastwood Road intersection.
3. Construct TH 14 as a four-lane expressway east of 40th Avenue through the 50th Avenue intersection. Also, improve the sight distance on TH 14 at the 40th Avenue intersection by reconstructing the vertical alignment on TH 14 to provide more gradual vertical grade changes near the 40th Avenue intersection.

Along with installing a traffic signal at the Marion Road/Eastwood Road intersection, the relocation of the Eastwood Road approach to approximately 600 feet to the south of its existing location should be considered even though it is not required. Doing this would allow the intersection to meet Mn/DOT's recommended minimum spacing guidelines between signalized intersections and to provide adequate distance between intersections such that the zones of influence that effect drivers do not overlap (see discussion in Section 3.2.1).

Roadway and Intersection Mitigations

(Mitigations are enhancements that would be needed under full build-out of the 2025 development scenario in order to achieve desired levels-of-service. They would be in addition to the improvements listed above.)

1. At the TH 14 / 40th Avenue intersection:
 - Install a traffic signal with "exclusive" only left turn phasing for all approaches.
 - Construct the south approach to accommodate dual left turn lanes, a through lane, and a right turn lane.
 - Construct the north approach to accommodate a left turn, through, and right turn lane to complement the geometry on the south approach.
2. Construct Marion Road as a four-lane divided roadway between 20th Street and 40th Avenue.

The mitigations identified apply to county and state roadways. Therefore, if the project area is built out according to the development scenario and future-year traffic results in congestion necessitating these mitigations, it is expected that Olmsted County and Mn/DOT would lead the design, construction, and financing of their respective facilities. The role of the City of Rochester would be to participate in project development, right-of-way acquisition and financing based on established project participation guidelines of MnDOT and Olmsted County.

Factors influencing Implementation of Improvements and Mitigations

Signal Justification Reports

As stated in the no-development scenario, prior to installation of a traffic signal, a Signal Justification Report (SJR) should be completed including an analysis of the documented warrants for signalization. Based on the development scenario volumes at the TH 14 / 40th Avenue and Marion Road / Eastwood Road intersections, **Attachment B** shows that both intersections would be expected to exceed the traffic volume thresholds for the Peak Hour Volume Warrant (Warrant 11). An approximate straight-line analysis between the existing and 2025 development volumes was conducted to determine when the peak hour volume warrant would be

expected to be met for both intersections. If the traffic volumes increase at a constant rate, the peak hour volume warrant could potentially be met by 2006 for the TH 14/40th Avenue intersection and by 2008 for the Marion Road/Eastwood Road intersection. However, it is not likely that the development will occur constantly from year to year. It is more likely that the expected development will occur in steps. For example, in one or two years there may be no new development, and then the next year, several residential units may be constructed.

Correcting Sight Distance at TH 14 / 40th Avenue SE intersection

Currently, there is poor sight distance for vehicles on TH 14 near the 40th Avenue intersection and for vehicles entering TH 14 from the 40th Avenue north and south approaches. Prior to installation of a traffic signal at this intersection, the sight distance would need to be improved so that vehicles traveling on TH 14 would have adequate time to react to signal changes. Correcting the intersection sight distance has been identified as part of the necessary TH 14 improvements, regardless of whether additional development occurs in the project area. Improving the sight distance would involve reconstructing the vertical alignment on TH 14 by providing more gradual vertical grade changes near the 40th Avenue intersection. In addition to improving the sight distance, advance warning flashers (AWF) could also be installed on TH 14 to provide a supplementary notification of the signal change. MNDOT has identified the upgrading of TH 14 to a four – lane east to Eyota, Minnesota in its Work Studies Program as a candidate project for the Year 2008. This project would include correction of the sight distance problems at this intersection.

Marion Road Roadway Capacity north of Eastwood Road

Due to the close spacing of the TH 14 and Eastwood Road intersections on Marion Road (approximately 800 feet apart), the level of service on this section of roadway is expected to be controlled by the capacity at the intersections. One of the improvements identified for the No-Development Scenario was to add a second left turn lane and right turn lane on the south approach at the TH 14 / Marion Road intersection. Addition of these turn lanes is expected to increase the capacity at this intersection and thus increase the capacity of Marion Road between TH 14 and Eastwood Road by approximately 300 vehicles per hour per lane. Therefore, the total capacity of this roadway section is expected to increase to 1,100 vehicles per hour per lane with the improvements and the roadway segment is expected to operate at a LOS A for the development scenario.

20th St SE Extension

It was determined that, even with the improvements and mitigations identified, the TH 14/Marion Road intersection is expected to operate at an overall LOS D during the PM peak hour under the 2025 Development Scenario. It should be noted that all individual movements associated with the intersection operated at acceptable levels of service. This suggests that under full build-out of the Development Scenario, there *may* be a point in time where the overall operation of the TH 14 / Marion Road intersection will deteriorate to where it would be considered deficient. This assumes that the actual pattern of traffic growth reflects the assumptions made in the study.

In an effort to identify additional mitigation measures that could raise the overall LOS for this intersection to the C/D boundary if the projected traffic growth was realized, an analysis examining the effects of constructing a new 20th Street connection between Marion Road and 11th Avenue (CSAH 1) was conducted. The 20th St connection is a corridor identified on the regional long range thoroughfare plan and it is a facility that would connect two county road corridors on east (CSAH 36 and CR 143) with two county road corridors on the west (CSAH 1 and CR 146). The analysis found that construction of the 20th St connection would likely raise the overall level of service at the intersection of Marion Road and TH 14 to a LOS C, compared to LOS D without the connection. This suggests that if conditions at the Marion Road / TH 14 intersection continue to deteriorate even after identified improvements are made, there may be a need to consider the extension of the 20th St as a measure to address potential congestion problems at the TH 14 Marion Road intersection in the future.

Similarly, the growth of traffic on Marion Road between 20th St and 40th St varies with the presence or absence of the 20th St extension, such that the need for widening this section of Marion Road is linked to not only the extent of development in the study area but the presence or absence of the 20th St extension as well.

Given the uncertainty in terms of both the extent of development in the study area and traffic growth on various road segments and at various intersections, a Monitoring Program (as discussed in Section 4.4) is proposed to track traffic growth to determine when the City of Rochester should initiate, in conjunction with the appropriate road authorities, further studies and project development activities to determine the timing and phasing of actual improvement needs. Such activities are a necessary step leading to capital programming decisions to address deficiencies in roadway operation. While the AUAR identifies the need for potential mitigation measures, it cannot dictate programming decisions that need to follow the normally accepted practices of the roadway authorities, including Mn/DOT (in the case of TH 14, for example) and Olmsted County (in the case of Marion Road, for example).

In order to understand what level of proposed development may trigger LOS D or worse conditions at the TH 14/Marion Road intersection (assuming all intersection improvements are made), an analysis was completed to determine what level of traffic above the conditions existing today would clearly cause the level of service to drop to LOS D. The analysis utilized the PM peak hour intersection forecasts of the no-development and development scenarios to determine what level of traffic would trigger the drop in LOS. The differences in the PM peak hour turning movement volumes between the two scenarios at the TH 14/Marion Road intersection were first calculated. The differences for each movement were then added to the no-development PM peak hour turning movement volumes in 5% increments and re-analyzed until it was evident that the intersection would operate at LOS D during the PM peak hour under the given forecast conditions.

The analysis revealed that LOS D conditions would likely occur at the TH 14/Marion Road intersection when the PM peak hour traffic increases to 85% over the existing level of traffic at the intersection. This suggests that a significant share of the study area development scenario could be built out before traffic conditions would suggest the need to consider implementing a 20th St SE extension. Therefore, further study of whether a new 20th Street connection should be constructed would not need to occur until much of the development is already in place. In order to provide adequate time for study prior to reaching 85% of full traffic growth, it is recommended that the necessary studies to determine if a new 20th Street connection should be constructed be initiated once the level of traffic at the TH 14 / Marion Road intersection exceeds 70% of level assumed in the full development scenario. This should provide enough time to determine if 20th Street may be needed before conditions at the TH 14/Marion Road intersection deteriorate below a LOS C.

Roadway and Intersection Mitigations Needed if New 20th Street Connection is Programmed

If the extent of development and traffic growth requires consideration of the 20th St connection, the following ancillary improvements at the Marion Road/20th Street intersection and the Marion Road/40th Avenue intersection should be considered:

1. At the Marion Road/20th Street intersection:
 - Install a traffic signal with “exclusive/permitted” left turn phasing for all approaches.
 - Design Marion Road (north and south approaches) to provide a left-turn lane, two through lanes, and a right-turn lane.
 - Design 20th Street (east and west approaches) to provide a left-turn lane, at least one through lane, and a right-turn lane.
2. At the Marion Road/40th Avenue intersection:
 - Design the 40th Avenue approach to provide a left-turn lane and right-turn lane.
 - Design the Marion Road north approach to provide a left-turn lane and through lane.
 - Design the Marion Road south approach to provide a through lane and right-turn lane.

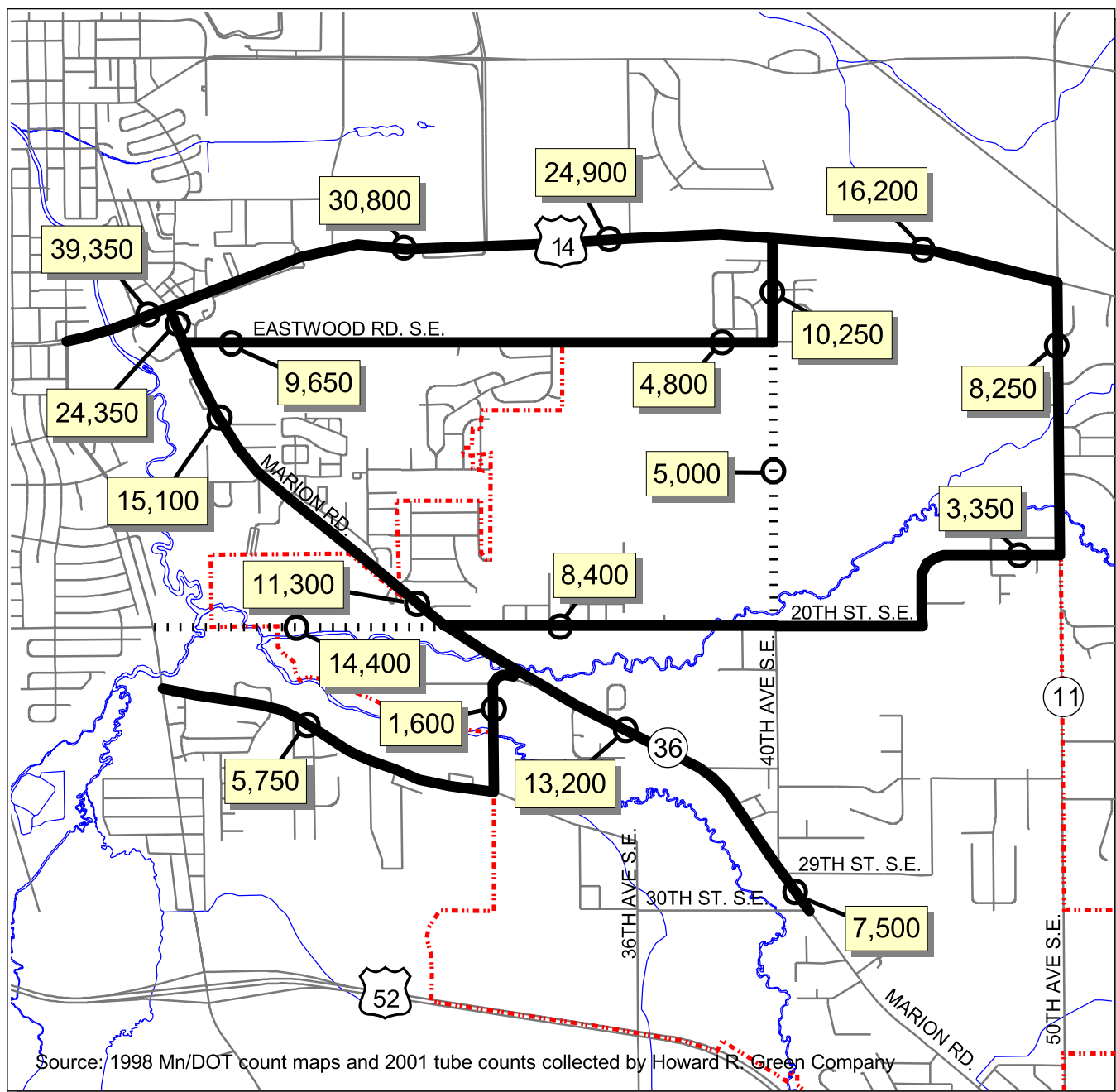
Traffic forecasts for a year 2025 development scenario with all of the mitigations and the 20th Street (CR 143) connection were developed and analyzed to determine the traffic impacts. Using the methodology described earlier in this chapter, year 2025 ADT forecasts were developed and are displayed in **Figure 3-5**. **Table 3-13** compares this scenario to all other ADT forecast scenarios. The table shows that with the 20th Street (CR 143) connection, the traffic volumes on Marion Road north of 20th Street and on TH 14 west of Marion Road are expected to decrease. However, the traffic volumes south of 20th Street on Marion Road and on 20th Street are expected to increase.

The year 2025 peak hour turn movements for the development scenario with the 20th Street (CR 143) connection are presented in **Table 3-14**. The growth in the turn movements is reflective of the growth in the ADT volumes. The year 2025 Development ADT and turn movements with the 20th Street connection for the key roadways and intersections were analyzed using the LOS and queuing analysis methodology described in Section 2.4.1. **Table 3-15** presents the estimated roadway LOS for the key roadways under this scenario. The LOS estimates were developed assuming that all roadway improvements and mitigation measures are in place. The table shows that, by constructing 20th Street as a four-lane section, all primary roadway segments are expected to operate at LOS C or better and all secondary roadway segments are expected to operate at a LOS D or better. It should be noted that if the 20th Street connection were constructed as a two-lane roadway with NO access between Marion Road and 11th Avenue, it would be expected to operate at LOS D. Once the project development process for a new 20th Street connection is initiated, further traffic forecasting and operations analysis should be completed to determine the exact facility type for the roadway.

Table 3-16 displays the geometric and traffic control assumptions made assuming that all roadway improvements and mitigation measures including the 20th Street connection and related improvements are in place for the 2025 development scenario. **Table 3-17** displays the estimated LOS for the key intersections both with and without the 20th Street connection and related enhancements. The first set of LOS estimates shown in **Table 3-17** is for development conditions with all improvements and mitigations except the 20th Street connection and related enhancements. The second set of LOS estimates is for development conditions with all improvements and mitigations including the 20th Street connection and related enhancements. Along with the 20th Street connection itself, related enhancements include intersection improvements and a traffic signal at the Marion Road/20th Street intersection and intersection improvements at the Marion Road/40th Avenue intersection. These enhancements are assumed to be in place for the second set of LOS estimates. If the proposed 20th Street connection were built without these related enhancements, the Marion Road intersections with 20th Street and 40th Avenue would both be expected to operate at LOS F in 2025 during the PM peak hour. **Attachment C** shows that, based on the development scenario volumes with the 20th Street connection, the Marion Road/20th Street intersection would be expected to exceed the traffic volume thresholds for the Peak Hour Volume Warrant (Warrant 11) in both the AM and PM peak hours.

Table 3-17 shows that, with the 20th Street connection and related enhancements in place, the following intersections improve from LOS D to LOS C or better under the development scenario:

- TH 14/Marion Road (PM peak hour)
- Marion Road/20th Street (AM and PM peak hour)
- Marion Road/40th Avenue (PM peak hour)



Legend

Informational Items

- Existing Streets
- Water
- AUAR Project Area
- Potential Roadway Connections



Existing Roadways Studied

1,000

2025 Development (with 20th Street Connection) ADT Forecasts

0 0.5 1 1.5 Miles



Figure 3-5

2025 Development Scenario with
20th Street Connection ADT Forecasts

Table 3-13
Year 2025 Average Daily Traffic (ADT) for Key Roadways- All Scenarios
Marion Road AUAR

Segment	Start Point	End Point	Existing ADT	2025 No- Development ADT	2025 Development ADT	2025 Development ADT with 20th St Connection	Percent Increase in 2025	
							Development with 20th St Connection ADT over Existing ADT	Existing ADT
TH 14	West of Marion Road	Marion Road	21,700	40,000	44,150	39,350	81%	
TH 14	Marion Road	East Circle Drive	15,300	30,700	31,450	30,800	101%	
TH 14	East Circle Drive	40th Avenue	13,000	15,800	26,000	24,900	92%	
TH 14	40th Avenue	East of 40th Avenue	11,700	15,700	16,350	16,200	38%	
Marion Road	TH 14	Eastwood Road	15,900	19,800	30,700	24,350	53%	
Marion Road	Eastwood Road	Sect S of Eastwood	13,400	14,900	20,600	15,100	13%	
Marion Road	Sect N of 20th St	20th Street	7,100	7,650	13,300	11,300	59%	
Marion Road	20th Street	40th Avenue	6,200	6,850	11,600	13,200	113%	
Marion Road	40th Avenue	Sect S of 40th Ave	NA	3,200	6,200	7,500	NA	
Eastwood Rd	Marion Road	Sect E of Marion	3,950	4,900	10,400	9,650	144%	
Eastwood Rd	Sect W of 40th Ave	40th Avenue	285	1,750	5,550	4,800	1584%	
20th Street	Marion Road	Sect E of Marion	2,500	2,600	6,250	8,400	236%	
20th Street	Sect W of CSAH 11	CSAH 11	660	700	3,350	3,350	408%	
40th Avenue	TH 14	Eastwood Road	1,800	1,900	10,900	5,000	178%	
40th Avenue	Eastwood Road	20th Street	NA	NA	4,000	10,250	NA	
20th Street	11th Avenue	Marion Road	NA	NA	NA	14,400	NA	
Pinewood Rd	11th Avenue	30th Avenue	2,000	4,000	8,900	5,750	188%	
30th Avenue	Pinewood Road	Marion Road	NA	1,900	4,600	1,600	NA	
50th Avenue	TH 14	Sect S of TH 14	3,350	6,300	8,500	8,250	146%	

Table 3-14

2025 Development Turning Movement Volumes for Key Intersections With the 20th Street Connection

Marion Road AUAR

AM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
TH 14												
Minor Street												
TH 14 / Marion Rd	197	523	204	69	742	217	373	436	118	52	207	183
TH 14 / 40th Ave SE	53	444	477	44	878	21	345	52	23	5	35	164
Marion Road												
Marion Rd / Eastwood Rd SE	31	12	25	13	23	207	29	540	23	97	266	3
Marion Rd / 20th St SE	138	221	244	18	331	115	367	384	138	77	256	138
Marion Rd / 40th Ave SE	0	0	0	19	0	11	0	436	13	0	118	0

PM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
TH 14												
Minor Street												
TH 14 / Marion Rd	322	1042	560	195	781	144	459	391	117	295	595	387
TH 14 / 40th Ave SE	164	878	345	23	444	5	477	35	44	11	52	53
Marion Road												
Marion Rd / Eastwood Rd SE	20	6	59	166	7	508	27	410	25	202	820	39
Marion Rd / 20th St SE	138	331	367	18	221	77	244	256	138	115	384	138
Marion Rd / 40th St SE	0	0	0	207	0	33	0	331	56	7	509	0

Notes:

(1) 2025 forecast volumes developed by Howard R. Green Company using ROCOG Travel Demand Model.

Table 3-15

2025 Development PM Peak Hour Segment Level of Service for Key Roadways With All Improvements and Mitigations Including 20th Street

Marion Road AUAR

Segment	Start Point	End Point	Existing ADT	2025 Post-Development ADT with 20th St Connection	Roadway Classification	Roadway Section	Theoretical Peak Hour Density ⁽¹⁾ (pcphpl)	Actual Peak Hour Density ^{(2),(3)} (pcphpl)	LOS
TH 14	West of Marion Road	Marion Road	21,700	39,350	Rural Expressway	4-Lane	1400	940	B
TH 14	Marion Road	East Circle Drive	31,450	30,800	Rural Expressway	4-Lane	1100	740	B
TH 14	East Circle Drive	40th Avenue	13,000	24,900	Rural Expressway	4-Lane	1100	600	A
TH 14	40th Avenue	East of 40th Avenue	11,700	16,200	Rural Expressway	4-Lane	1100	780	C
Marion Road	TH 14	Eastwood Road	15,900	24,350	Class I Arterial	4-Lane	1100	580	A
Marion Road	Eastwood Road	Sect S of Eastwood	13,400	15,100	Class I Arterial	4-Lane	800	360	A
Marion Road	Sect N of 20th St	20th Street	7,100	11,300	Class I Arterial	4-Lane	800	270	A
Marion Road	20th Street	40th Avenue	6,200	13,200	Class I Arterial	4-Lane	800	630	C
Marion Road	40th Avenue	Sect S of 40th Ave	NA	7,500	Class I Arterial	2-Lane	600	360	B
Eastwood Rd	Marion Road	Sect E of Marion	3,950	9,650	Class II Arterial	2-Lane	600	460	C
Eastwood Rd	Sect W of 40th Ave	40th Avenue	285	4,800	Class II Arterial	2-Lane	600	230	A
20th Street	Marion Road	Sect E of Marion	2,500	8,400	Class II Arterial	2-Lane	600	400	B
20th Street	Sect W of CSAH 11	CSAH 11	660	3,350	Class II Arterial	2-Lane	600	160	A
40th Avenue	Eastwood Road	20th Street	NA	5,000	Class II Arterial	2-Lane	600	240	A
40th Avenue	TH 14	Eastwood Road	1,800	10,250	Class II Arterial	2-Lane	600	490	D
20th Street	11th Avenue	Marion Road	NA	14,400	Class II Arterial	4-Lane ⁽⁴⁾	800	350	A
Pinewood Rd	11th Avenue	30th Avenue	2,000	5,750	Class II Arterial	2-Lane	600	280	A
30th Avenue	Pinewood Road	Marion Road	NA	1,600	Class II Arterial	2-Lane	600	80	A
50th Avenue	TH 14	Sect S of TH 14	3,350	8,250	Class II Arterial	2-Lane	600	400	B

Notes:

(1) The theoretical peak hour density is different for different types of roadways.

(2) The existing PM peak hour density was calculated by applying a 8% peak hour factor (based on existing counts) to the ADT and then dividing by the total number of lanes.

(This methodology assumes a 60-40 split of traffic volumes in each direction of the roadway based on existing traffic counts)

(3) The volumes listed are peak hour by direction (pcphpl = passenger cars per hour per lane)

(4) New 20th Street connection is estimated to operate at LOS D as a two-lane facility assuming that turn lanes are built out at Marion Road and 11th Avenue and there is NO access in between.

TABLE 3-16

Development Scenario Geometry and Traffic Control Mitigations for Key Intersections With All Improvements and Mitigations Including 20th Street
Marion Road AUAR

INTERSECTION	WEST APPROACH	EAST APPROACH	SOUTH APPROACH	NORTH APPROACH	TRAFFIC CONTROL	MAINLINE LEFT TURN PHASING	SIDE STREET LEFT TURN PHASING
TH 14							
Minor Street							
TH 14 / Marion Road					Signal	Exclusive	Exclusive
TH 14 / 40th Avenue SE					Signal	Exclusive	Exclusive
Marion Road							
Minor Street							
Marion Road / Eastwood Road SE					Signal	Exclusive / Permitted	Permitted
Marion Road / 20th Street SE					Signal	Exclusive / Permitted	Exclusive / Permitted
Marion Road / 40th Avenue SE	n.a.				Thru-STOP	n.a.	n.a.

NOTE: Thru-Stop indicates that the minor street approaches have a stop sign for oncoming vehicles but the major street approaches do not.

- Indicates existing geometry and roadway improvements

- Indicates mitigation measure

Table 3-17

2025 Development Level of Service for Key Intersections with All Improvements and Mitigations (with and without 20th Street)
Marion Road AUAR

AM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach			Intersection LOS ⁽¹⁾
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
	TH 14			Minor Street			Minor Street			Minor Street			
TH 14 / Marion Road ^(2,4)	C/D	B/B	A/A	D/D	C/C	A/A	D/D	C/C	A/A	D/D	C/C	B/A	C / C
TH 14 / 40th Avenue SE	D/D	B/B	A/A	D/D	B/B	A/A	D/D	C/C	B/B	D/D	D/D	A/A	B / B
	Minor Street			Minor Street			Marion Road			Marion Road			
Marion Road / Eastwood Road ⁽⁴⁾	B/B	B/B	A/A	B/B	B/B	A/A	A/A	B/B	A/A	A/A	B/B	A/A	A / A
Marion Road / 20th Street SE	NA/B	NA/C	NA/A	D/B	NA/B	B/A	NA/B	NA/B	NA/A	A/B	NA/C	NA/A	D / B
Marion Road / 40th Avenue SE ⁽³⁾	NA	NA	NA	A/A	NA	A/A	NA	NA	NA	A/A	NA	NA	A / A

PM Peak Hour

Location	West Approach			East Approach			South Approach			North Approach			Intersection LOS ⁽¹⁾
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
	TH 14			TH 14			Minor Street			Minor Street			
TH 14 / Marion Road ^(2,4)	D/D	D/C	C/B	D/D	C/C	C/A	E/D	D/D	A/B	D/D	E/D	C/B	D / C
TH 14 / 40th Avenue SE	D/D	B/B	A/A	D/D	B/B	B/B	D/D	C/C	A/A	D/D	D/D	B/B	C / C
	Minor Street			Minor Street			Marion Road			Marion Road			
Marion Road / Eastwood Road ⁽⁴⁾	C/B	B/B	A/A	C/C	B/C	B/B	B/B	B/B	A/A	B/B	B/A	A/A	B / A
Marion Road / 20th Street SE	NA/B	NA/C	NA/A	D/B	NA/B	B/A	NA/B	NA/C	NA/A	A/B	NA/B	NA/A	D / B
Marion Road / 40th Avenue SE ⁽³⁾	NA	NA	NA	D/B	NA	B/B	NA	NA	NA	A/A	NA	NA	D / B

Notes:

GENERAL NOTE: The first LOS estimate shown represents the conditions WITHOUT the 20th Street connection and the second LOS estimate shown represents the conditions WITH the 20th Street connection and related mitigations.

(1) The intersection level of service reported for unsignalized intersections represents the worst movement level of service.

(2) Signalized Intersection

(3) Unsignalized Intersection

(4) LOS results from SimTraffic™

Table 3-18 shows a summary of the intersection level of service for all scenarios analyzed. The last column in the table displays the intersection LOS for the development scenario assuming all improvements and mitigations are in place. Similar to the previous table, the first LOS estimate displayed in the last column table assumes the 20th street connection and related enhancements are not in place. The second LOS estimate assumes the 20th street connection and related enhancements are in place. The table demonstrates that the TH 14/Marion Road and the Marion Road/Eastwood Road intersections exceed ROCOG's index of congestion today during the PM peak hour and that conditions at these intersections are expected to worsen over time even if no development occurs in the project area. If development in the project area does occur as hypothesized, by 2025 the TH 14/Marion Road, TH 14/40th Avenue, and Marion Road/Eastwood Road intersections will exceed ROCOG's index of congestion in the AM and PM peak hours if no improvements and mitigations are made. If the suggested improvements and mitigations are put into place, traffic operations at the key intersections will improve.

Table 3-18
Intersection Level of Service Summary
Marion Road AUAR

Location	Year 2001 Existing	Year 2025			
		No-Development	No-Development with Roadway Improvements	Development No Roadway Improvements	Development with Roadway Improvements and Mitigations ⁽⁵⁾
TH 14 / Marion Road ^(2,4)	B	C	B	F	C / C
TH 14 / 40th Avenue SE ⁽³⁾	C	C	C	F	B / B
Marion Road / Eastwood Road ^(3,4)	B	C	C	F	A / A
Marion Road / 20th Street SE ⁽³⁾	B	C	C	D	D / B
Marion Road / 40th Avenue SE ⁽³⁾	A	B	B	B	A / A

Location	Year 2001 Existing	Year 2025			
		No-Development	No-Development with Roadway Improvements	Development No Roadway Improvements	Development with Roadway Improvements and Mitigations ⁽⁵⁾
TH 14 / Marion Road ^(2,4)	D	F	C	F	D / C
TH 14 / 40th Avenue SE ⁽³⁾	D	D	D	F	C / C
Marion Road / Eastwood Road ^(3,4)	E	F	F/A ⁽⁶⁾	F	B / A
Marion Road / 20th Street SE ⁽³⁾	B	B	B	D	D / B
Marion Road / 40th Avenue SE ⁽³⁾	B	B	B	D	D / B

Notes:

General Note: Shaded results indicates LOS estimate exceeds ROCOG Index of Congestion.

(1) The intersection level of service reported for unsignalized intersections represents the worst movement level of service.

(2) Signalized Intersection

(3) Unsignalized Intersection

(4) LOS results from SimTraffic TM

(5) The first LOS estimate represents the conditions WITHOUT the 20th Street connection and the second LOS estimate represents the conditions WITH the 20th Street connection and related mitigation:

(6) The first LOS represents unsignalized conditions and the second LOS represents signalized conditions.

4.0 IMPROVEMENT AND MITIGATION PLAN

The purpose of this section is to: list the roadway and intersection improvements and mitigations that were identified in Chapter 3; discuss guidelines for potential signalization of intersections; discuss jurisdictional issues relating to implementing improvements and/or mitigations; and identify potential volume triggers/guidelines for the implementation of the improvements and/or mitigations.

4.1 Improvements and Mitigations Summary

For the purposes of this report, “improvements” are defined as roadway enhancements needed to eliminate deficiencies that are expected to occur under the 2025 no-development scenario. “Mitigations” are defined as roadway enhancements that are required to eliminate the additional 2025 deficiencies that are associated solely with the development scenario.

4.1.1 Intersection and Roadway Improvements

The different types of improvements examined include existing roadway reconstruction, new roadway construction, altering traffic control, and optimizing the existing signal system. A number of different types of improvement strategies were iteratively examined in order to determine the best mix of enhancements. Based on this process, the following improvements were identified:

1. Reconstruct the TH 14 / Marion Road intersection to accommodate dual left turns, two through lanes, and a right turn lane on all approaches.
2. Install a traffic signal at the Marion Road / Eastwood Road intersection.
3. Construct TH 14 as a four-lane expressway east of 40th Avenue through the 50th Avenue intersection. Improve the sight distance on TH 14 at 40th Avenue by reconstructing the vertical alignment on TH 14 to provide more gradual vertical grade changes near the 40th Avenue intersection.

Along with installing a traffic signal at the Marion Road/Eastwood Road intersection, the relocation of the Eastwood Road approach to approximately 600-700 feet south of its existing location should be considered even though it is not required. By relocating the intersection, the distance between the TH 14 and Eastwood Road intersections would meet Mn/DOT recommended minimum spacing guidelines of ¼ mile (1,320 feet) and the zones of influence that affect drivers would not overlap. However, it should be noted that relocation of the intersection would require additional right-of-way, potential property acquisitions and significant grading of the existing steep, forested slopes.

4.1.2 Intersection and Roadway Mitigations

Mitigations are enhancements recommended under full build out of the 2025 development scenario in order to achieve desired levels-of-service. They would be in addition to the improvements listed above and are as follows:

1. At the TH 14 / 40th Avenue intersection:
 - Install a traffic signal with “exclusive” only left turn phasing for all approaches.
 - Construct the south approach to accommodate dual left turn lanes, a through lane, and a right turn lane.
 - Construct the north approach to accommodate a left turn, through, and right turn lane to complement the geometry on the south approach.
2. Construct Marion Road as a four-lane divided roadway between 20th Street and 40th Avenue.

Because it was determined that the TH 14/Marion Road intersection is expected to operate at LOS D during the PM peak hour under full development even if the intersection was improved as described previously, an analysis examining the effects of constructing a new 20th Street connection between Marion Road and 11th Avenue (CSAH 1) was conducted. Specifically, the analysis examined the effect of all improvements and mitigations with and without the 20th Street connection. The analysis found that with the 20th St connection, the intersection of Marion Road and TH 14 would operate at an overall Level of Service of C, compared to LOS D without the connection, under full development. All individual movements would operate at an acceptable Level of Service regardless if the 20th Street connection was built. This suggests that under full development consistent with the development scenario, there *may* be a point in time where the operation of the TH 14 / Marion Road intersection will deteriorate to where it would be considered deficient. This of course would depend on the exact nature and intensity of development in the Study Area.

Similarly, the growth of traffic on Marion Road between 20th St and 40th St varies with the presence or absence of the 20th St extension, such that the need for widening this section of Marion Road is linked to not only the extent of development in the study area but the presence or absence of the 20th St extension as well.

Given the uncertainty in terms of both the extent of development in the study area and traffic growth on various road segments and at various intersections, a Monitoring Program (as discussed in Section 4.4) is proposed to track traffic growth to determine when the City of Rochester should initiate, in conjunction with the appropriate road authorities, further studies and project development activities to determine the timing and phasing of actual improvement needs. Such activities are a necessary step leading to capital programming decisions to address deficiencies in roadway operation. While the AUAR identifies the need for potential mitigation measures, it cannot dictate programming decisions that need to follow the normally accepted practices of the roadway authorities, including Mn/DOT (in the case of TH 14, for example) and Olmsted County (in the case of Marion Road, for example).

In order to better determine what level of the proposed development may trigger LOS D or worse conditions at the TH 14/Marion Road intersection (even if all recommended improvements are made), an analysis was completed to determine the traffic level at which the LOS at the intersection would clearly become LOS D. The analysis utilized the existing PM peak hour intersection traffic as well as forecasts of the no-development and development scenarios. The differences in the PM peak hour turning movement volumes between the two scenarios at the TH 14/Marion Road intersection were first calculated. The differences for each movement were then added to the no-development PM peak hour turning movement volumes in 5% increments and re-analyzed until it was evident that the intersection would operate at LOS D during the PM peak hour under the given forecast conditions. The analysis revealed that LOS D conditions would likely occur at the TH 14/Marion Road intersection if PM peak hour traffic grew by 85% over existing levels of traffic at the intersection.

Because analyses suggest that the TH 14/Marion Road intersection will not likely operate at LOS D until traffic growth reaches 85% of projected traffic levels associated with full development, further study of whether a new 20th Street connection should be constructed would not need to occur until much of the development is already in place. In order to provide adequate time for study prior to reaching 85% of full traffic growth, it is recommended that the necessary studies to validate if and when a new 20th Street connection should be constructed be initiated after the level of traffic growth at the Marion Road / TH14 intersection exceeds 70% of the level projected in the full development scenario. This should provide enough time to determine if 20th Street may be needed before conditions at the TH 14/Marion Road intersection deteriorate below a LOS C.

If the extent of development and traffic growth requires consideration of the 20th St connection, the following ancillary improvements at the Marion Road/20th Street intersection and the Marion Road/40th Avenue intersection should be considered:

1. At the Marion Road/20th Street intersection:
 - Install a traffic signal with “exclusive/permitted” left turn phasing for all approaches.
 - Design Marion Road (north and south approaches) to provide a left turn, two through lanes, and a right turn lane.
 - Design 20th Street (east and west approaches) to provide a left turn, through, and right turn lane.
2. At the Marion Road/40th Avenue intersection:
 - Design the 40th Avenue approach to provide a left and right turn lane.
 - Design the Marion Road north approach to provide a left turn and through lane.
 - Design the Marion Road south approach to provide a through and right turn lane.

Figure 4-1 provides an illustration of the improvements and mitigations listed.

4.2 Traffic Signal Installation

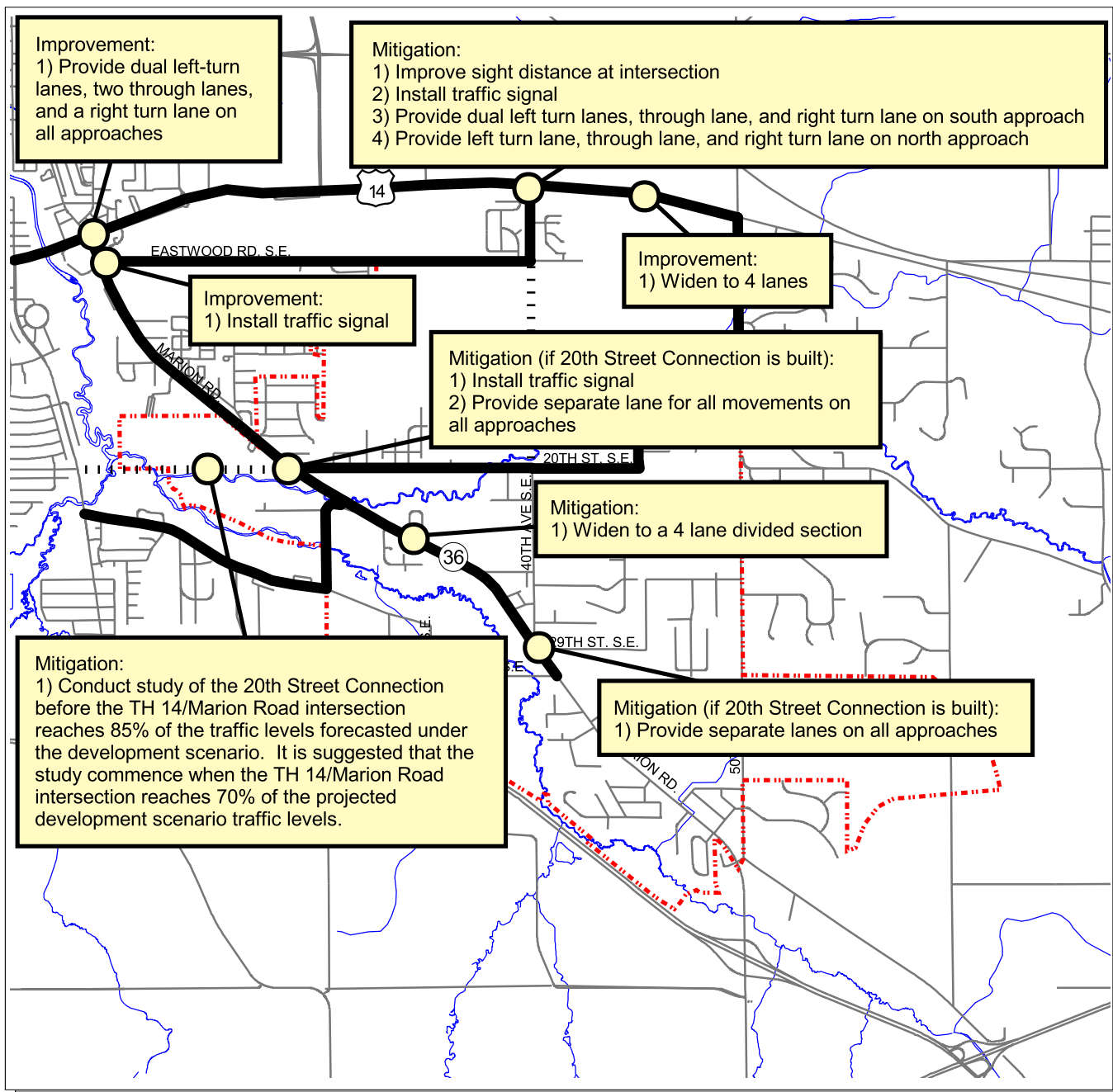
The results from the 2025 no-development and development scenarios identify large delays occurring on the minor street approaches at several thru-STOP intersections. One potential solution to improve the operations for these minor street movements is to install a traffic signal. With the installation of a traffic signal, there would now be a portion of time in which the major street traffic would be required to stop at the intersection while the signal is servicing the minor street movements. Therefore, the delays for the minor street would be expected to decrease; however, the delays for the major street would be expected to increase. Typically, the major street approaches have a significantly higher volume of traffic than the minor street approaches. If a greater volume of vehicles (major street approaches) is now experiencing a greater delay, the overall intersection LOS would be expected to decrease with the installation of a traffic signal compared to a thru-STOP condition.

Therefore, the Minnesota Department of Transportation and other agencies have established supplementary guidelines besides minor street delay for when and where to potentially install traffic signals. Two of these guidelines include:

1. Signal Justification Report
2. Recommended Minimum Signal Spacing

A Signal Justification Report (SJR) is a document that examines the existing conditions; provides a description of the project; discusses the need for the project; includes a signal warrant analysis; and states the reason for justification of a signal at the specific location. Warrants have been developed that provide a guideline for signalization. The criteria for meeting these guidelines are listed in the Minnesota Manual on Uniform Traffic Control Devices (MMUTCD). Justification for a signalized intersection should be based on meeting one or more of the established warrants in the MMUTCD. However, the meeting of a warrant or warrants does not alone justify the installation of a signal. Other additional studies should be conducted by the appropriate roadway authorities to determine if the installation of a traffic signal will improve overall safety and/or the operations of the intersection. Signal Justification Reports need to be approved by the appropriate roadway authorities prior to signal installation.

Mn/DOT has also established recommended access/signal spacing guidelines for different functionally classified roadways (e.g. high priority interregional corridors, principal arterials, collector arterials, etc.) Therefore, prior to installation of a traffic signal on TH 14 or Marion Road, these recommended signal spacing guidelines must also be considered. In the project area, TH 14 is listed as a high-priority *regional* corridor and is a Principal Arterial.



Legend

Informational Items

- Existing Streets
- River or Stream
- AUAR Project Area

Improvement = roadway enhancement necessary to eliminate deficiencies under the No-Development Scenario
Mitigation = roadway enhancement necessary to eliminate deficiencies under the Development Scenario only

- Potential Roadway Connections
- Existing Roadways Studied

Source: Howard R. Green Company

Note: 40th Avenue is assumed to be constructed as part of the Development Scenario

0 1000 2000 3000 4000 Feet



Figure 4-1

Potential Roadway Improvements and Mitigations

20 March 2002

For Principal Arterials, the signal spacing guidelines recommend that signals be spaced by a minimum of ½ mile for this type of roadway. Currently along TH 14 in the Project Area, there are signals at Marion Road, 30th Avenue, and 50th Avenue. Marion Road and 30th Avenue are spaced approximately one mile apart. 30th Avenue and 50th Avenue are spaced approximately two miles apart. Therefore, if a signal were installed at 40th Avenue (located midway between 30th Avenue and 50th Avenue), the signals spacing would be one mile, which is greater than the ½ mile spacing recommended in the Mn/DOT guidelines.

Marion Road is functionally classified as a Minor Arterial. Even though Marion Road is under the jurisdiction of Olmsted County, Mn/DOT's signal spacing guidelines do cover minor arterials. The guidelines recommend that signals be spaced by approximately a minimum of ¼ mile (1,320 feet) for this type of roadway. Along Marion Road in the Project Area, there are signals at TH 14 and Park Lane. If a signal were installed at Eastwood Road (located between TH 14 and Park Lane), the signal spacing between TH 14 and Eastwood Road would be approximately 800 feet, which is slightly less than the recommended minimum spacing of 1,320 feet (¼ mile). The signal spacing between Eastwood Road and Park Lane is approximately ½ to ¾ or a mile, which is greater than the recommended minimum spacing.

The Marion Road/20th Street intersection was also identified as a location where a traffic signal could be installed. The existing signal at the Park Lane intersection is approximately ½ to ¾ mile north of the Marion Road/20th Street intersection. Therefore, a signal at the Marion Road/20th Street intersection would also meet the recommended minimum signal spacing guideline of ¼ mile.

4.3 Jurisdictional Issues

The key roadways listed in the project area are owned and maintained by different agencies, which include Mn/DOT, Olmsted County, the City of Rochester, and Marion Township. If it is determined that improvements and/or mitigations are necessary to improve the traffic operations at a particular intersection or roadway section, coordination should occur between the governing agencies of the roadways to develop an improvement/mitigation strategy, determine right-of-way acquisition, etc. The key roadways and their associated governing agency are listed as follows:

1. TH 14 – Mn/DOT
2. Marion Road (CSAH 36)– Olmsted County
3. 11th Avenue (CSAH 1) – Olmsted County
4. Eastwood Road (CR 144)– Olmsted County
5. 20th Street (CR 143) – Olmsted County
6. 40th Avenue – Olmsted County (partial) and Marion Township (partial)
7. 30th Avenue –Marion Township
8. Pinewood Road - City of Rochester (partial) and Marion Township (partial)

For example, for the 2025 no-development scenario, a potential improvement was listed that included constructing the TH 14/Marion Road intersection to provide dual left turn lanes, two through lanes, and a right turn lane on all approaches. TH 14 is owned and maintained by Mn/DOT; Marion Road is owned and maintained by Olmsted County and 15th Avenue is owned and maintained by the City of Rochester. Therefore, when the improvement at this intersection becomes warranted (intersection operations are LOS D, E, or F), coordination between Mn/DOT, Olmsted County, and the City of Rochester should occur to discuss the geometric design of the intersection, to determine the timing of the design and construction of the intersection, to discuss potential cost sharing to provide the improvements, and to determine the appropriate right-of-way acquisition needed.

4.4 Traffic Monitoring for Improvements/Mitigations

The proposed development of the single and multiple-family residential units and commercial and industrial buildings is expected to occur incrementally over the next 25 years in the project area. Therefore, implementation of all improvement and mitigations listed are not expected to be needed immediately or at the same time. The timing and magnitude of the improvements and mitigations will be dependent on the size, type, and location of the developments that occur each year both inside and outside of the project area. Which improvements and mitigations will be needed first will depend on where and when developments occur.

It must be remembered that the development scenario examined here is a hypothetical scenario. If future land development in the project area deviates significantly from the proposed scenario, then the traffic impacts and ensuing potential improvements and mitigations might differ from what has been presented in this report.

Given that there are many uncertainties surrounding the timing and need for roadway improvements associated with development in the study area, it is recommended that the initial mitigation strategy associated with traffic impacts should be the establishment of a traffic monitoring program to track traffic growth on area roadways. The purpose of the traffic-monitoring program is to:

1. Identify if traffic has increased on key roadways in the study area?
2. Identify whether the increase in traffic is of such magnitude to warrant initiation of further assessment, project development, and programming recommendations?

In order to address the questions above, locations where project roadways should be monitored periodically need to be identified. Below are suggested locations for the appropriate state and local transportation departments to monitor traffic volumes in order to determine: (1) If roadway enhancements should be considered at that time, (2) if further study should begin, or (3) If the roadway is able maintain mobility without enhancements.

1. TH 14 West of Marion Road – Count A
2. TH 14 East of Marion Road – Count B
3. TH 14 West of 40th Avenue – Count C
4. TH 14 East of 40th Avenue – Count I
5. 40th Avenue South of TH 14 – Count E
6. Marion Road North of Eastwood Road – Count D
7. Marion Road South of 20th Street – Count G
8. Eastwood Road East of Marion Road – Count F
9. 20th Street East of Marion Road – Count H

Figure 4-2 shows the suggested locations where traffic monitoring could occur.

The type of monitoring that could be used would involve collecting hourly approach volumes over a 48-hour time period on a “typical” day in both directions on the roadway. A “typical” day is usually considered a Tuesday, Wednesday, or Thursday where no special events (concerts, major detours, traffic incidents, etc.) occur. These hourly approach volumes could then be averaged and summed over a 24-hour time period to develop average daily traffic volumes. These daily traffic volumes could then be used as a guide to determine if potential improvements and/or mitigations should be studied further. The objective of additional study would be to determine if the improvement in question should enter the project development and implementation phase.

As a recommendation, the appropriate roadway authorities should monitor the specific locations where development is expected to occur at least every four years. If the city receives a request for a large development occurring in the interval between monitoring years, a Traffic Impact Study, consistent with

the requirements of the City of Rochester, will be needed to assess the impact of the development on study area streets in the immediate area.

4.4.1 Traffic Monitoring for Signalization Needs

The Minnesota Department of Transportation has conducted several studies that examine estimating signal warrants using the daily traffic volumes on the major and minor street approaches. These studies provide approximate daily traffic volume thresholds for meeting signal Warrant 1 – Minimum Vehicular Volumes. **Figure 4-3** provides a graphical representation of these volume thresholds. If the major street has a daily volume less than 8,600 vehicles per day (vpd) AND the minor street has an approach volume less than 2,800 vpd, the minimum vehicular warrant is not expected to be met. If the major street has a daily volume greater than 11,900 vpd AND the minor street has an approach volume greater than 3,900 vpd, the minimum vehicular warrant is expected to be met.

Included below is a listing of the intersections and locations where the volume counts are suggested to be collected by the appropriate road authority. These counts should be applied to the graph shown in **Figure 4-3**. If the counts fall within the “warrant met” area of the chart, further study should be initiated to determine if a signal is actually warranted. The key intersections that should be monitored are listed below along with the corresponding count locations. These locations are shown in **Figure 4-2**.

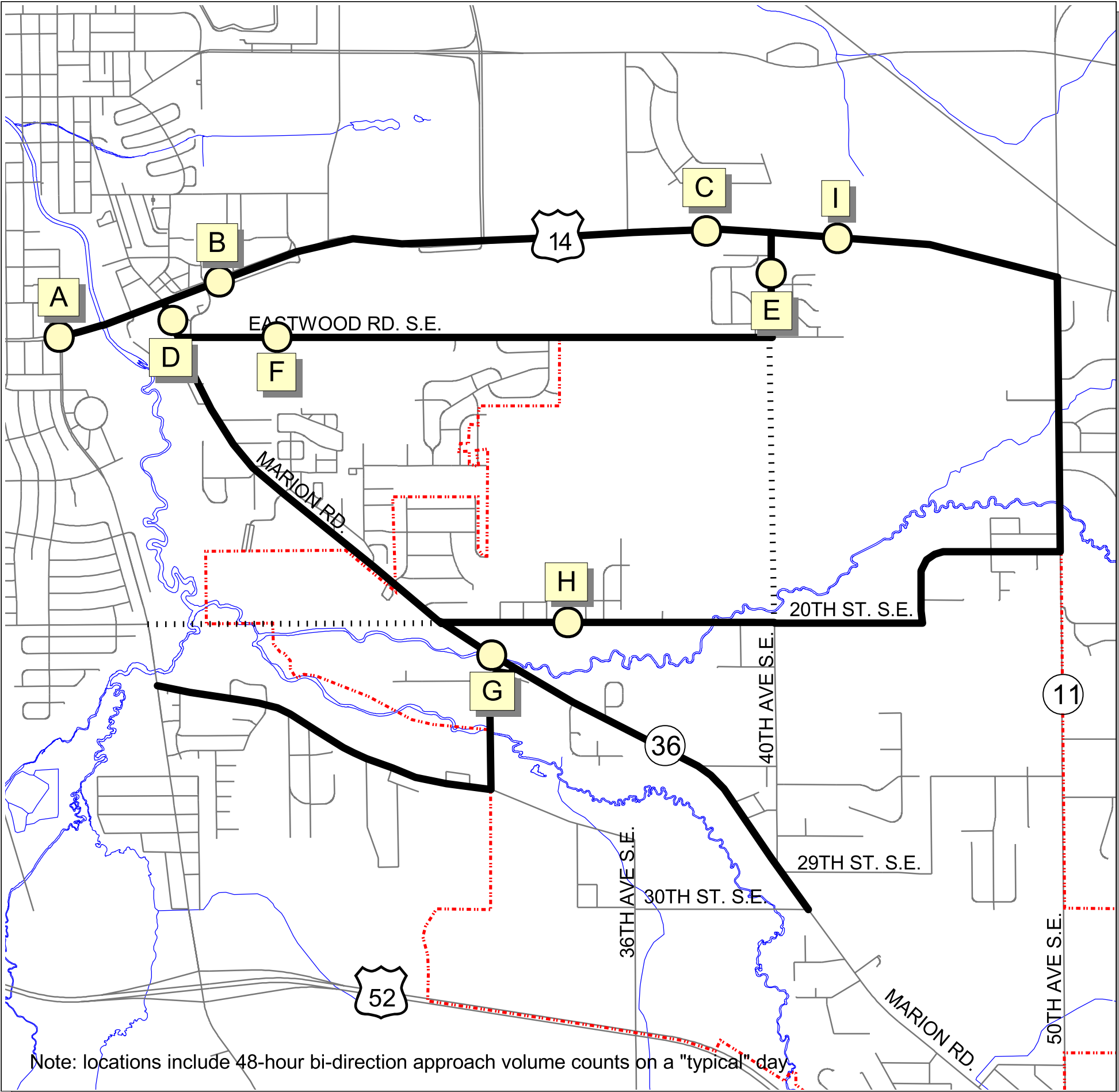
- TH 14/40th Avenue Intersection – Counts C and E
- Marion Road/Eastwood Road Intersection – Counts D and F
- Marion Road/20th Street Intersection – Counts G and H

4.4.2 Traffic Monitoring for Capacity Improvements/Mitigation Needs

Figure 4-4 provides a breakdown of roadway LOS by peak hourly directional flow for the different facility types. Traffic monitoring counts from key roadways should be compared to the chart on this figure to determine if potential improvements and/or mitigations for the roadway should be studied further. Given ROCOG’s index of congestion varies from the LOS C/D boundary to the LOS D/E boundary, a reasonable threshold for determining if roadway volumes suggest further study is the mid LOS C level. What this means is, if the hourly volume count on a specific segment indicates that the roadway is operating at the mid LOS C range or worse, a more detailed analysis should be conducted at the specific intersection or roadway. Below is a list of key roadways where facility type and intersection approach improvements may be needed. The monitoring count locations to help determine if potential improvements should be studied are identified for each intersection. The location of the monitoring counts are also shown in **Figure 4-2**.

- TH 14 West of Marion Road – Count A
- TH 14/Marion Road Intersections – Counts A, B, and D
- 20th Street Connection – Counts A, B, and D
- Marion Road/20th Street Intersection – Counts G and H

The thresholds selected for further study were developed knowing that the development and construction of roadway improvements can take anywhere from two to more than ten years depending on a number of factors. For example, some of the identified improvements and mitigations may require additional environmental documentation, detailed engineering design, and extensive right-of-way acquisition. The number of years required to implement a project is dependent on how each of these issues affects project development. The monitoring thresholds are designed to provide a period of time to develop an improvement project prior to the roadway or key intersection in question becoming deficient operationally.



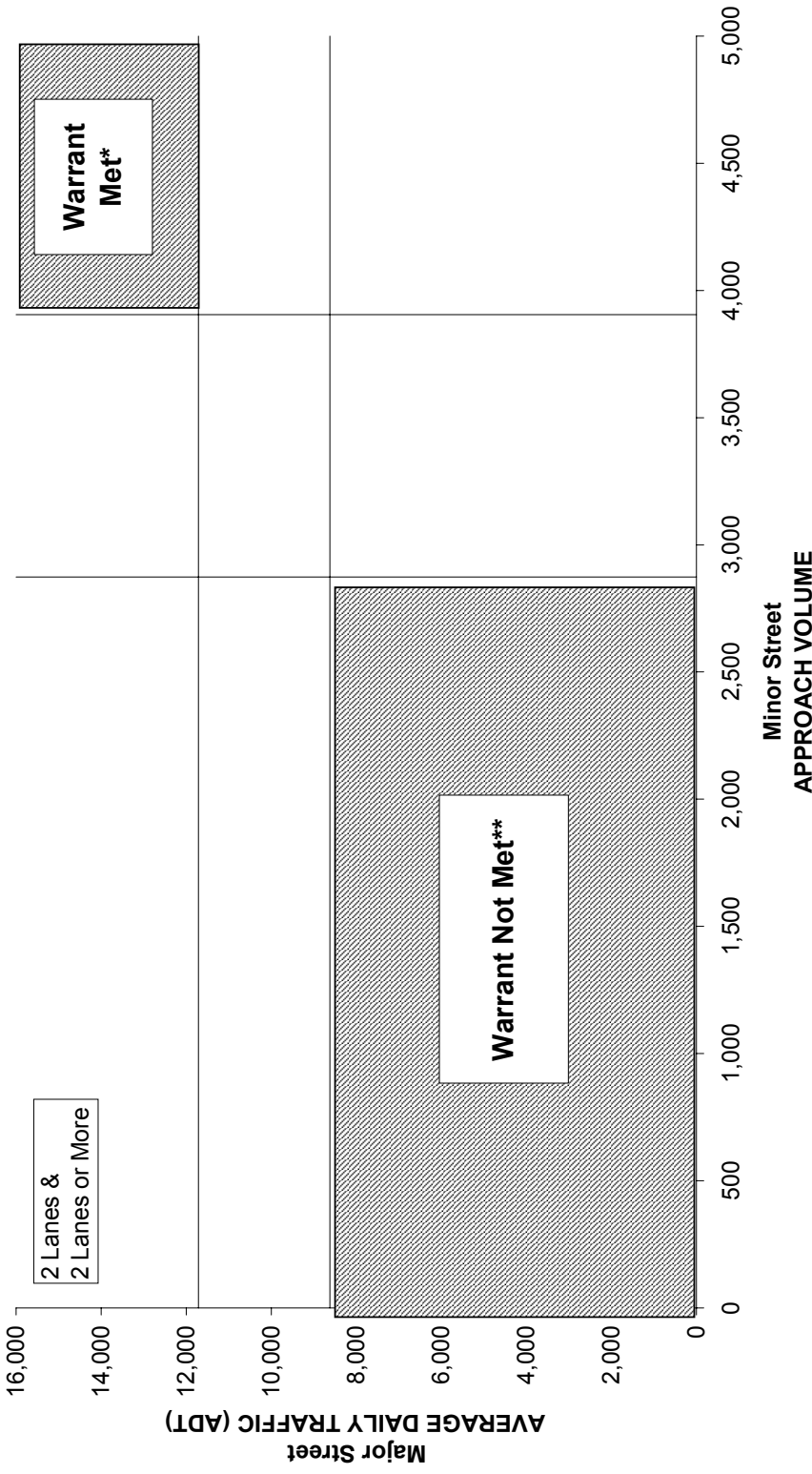
Legend

Informational Items

- Existing Streets
- Water
- AUAR Project Area
- Potential Roadway Connections
- Existing Roadways Studied



Figure 4-2
Suggested Traffic Monitoring Locations



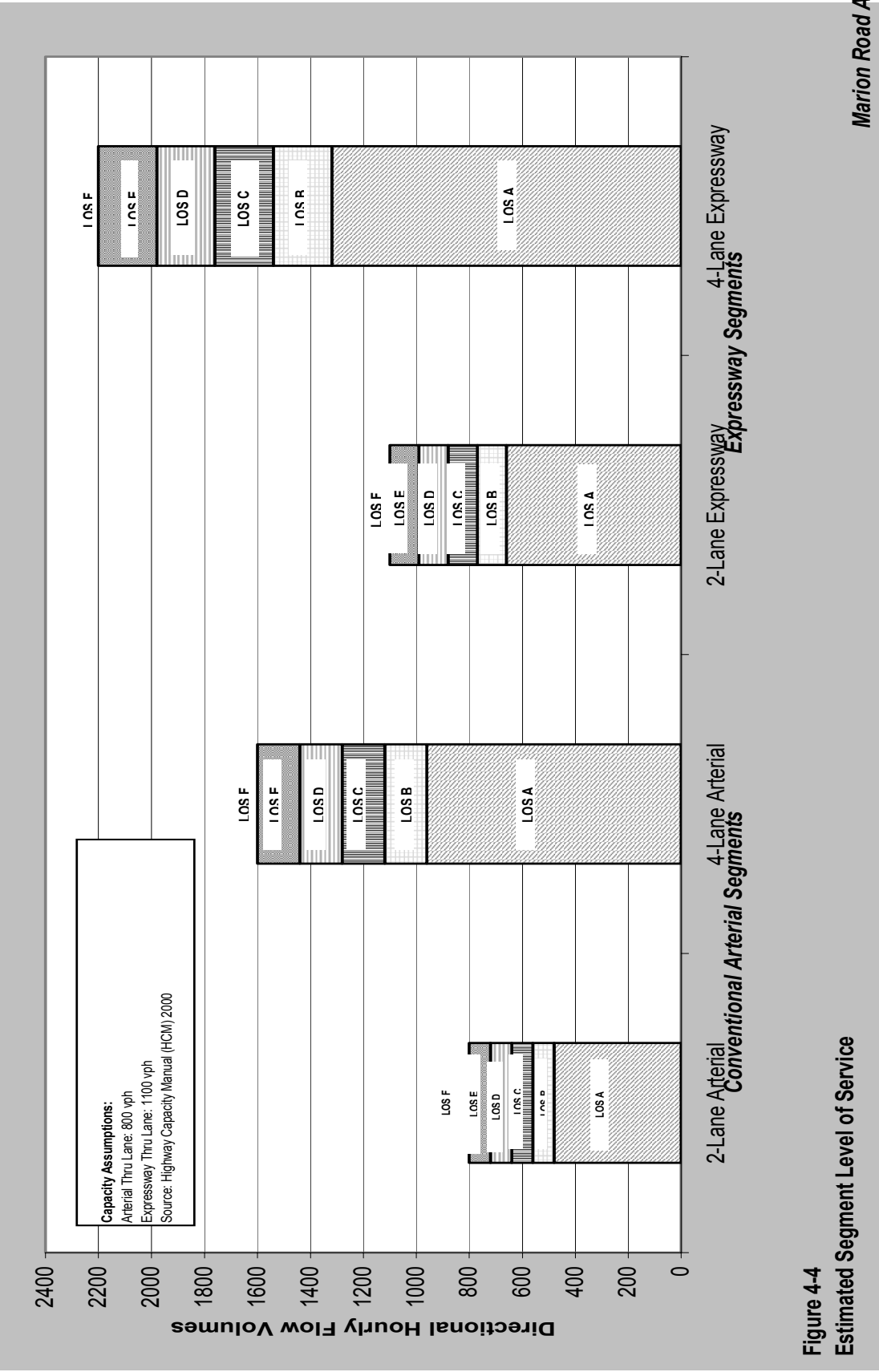
NOTE: A major street ADT and minor street approach volume falling outside of the shaded regions indicates hourly approach volumes will be needed to draw any conclusions whether the signal is or is not warranted under Warrant 1.

* A major street ADT and minor street approach volume falling in this range, warrants a traffic signal under warrant 1 with a 95%

** A major street ADT and minor street approach volume falling in this range, does not warrant a traffic signal under Warrant 1 with a 95%

Figure 4-3
Warrant 1 - Minimum Vehicle Movement

SIGNAL WARRANT ANALYSIS



5.0 FUTURE SYSTEM AND RIGHT-OF-WAY CONSIDERATIONS

The following paragraphs discuss issues related to the recommended roadway improvements and mitigations that are not needed to satisfy roadway operational goals, but that should be considered as part of overall roadway system planning for the purpose of providing for efficient roadway operation in the future.

5.1 Marion Road (CSAH 36) Lane Continuity

Marion Road is currently a four-lane undivided roadway from TH 14 south to Bear Creek. South of Bear Creek Marion Road becomes a two-lane road. Projected 2025 traffic volumes under the no-development scenario indicate a need to widen Marion Road to four lanes from CR 11 to TH 52. Consideration should be given in the future to widening the section of Marion Road between Bear Creek and CR 11 to four lanes to maintain lane continuity and prevent the creation of bottlenecks at north and south transition points if a four lane upgrade is completed between CR 11 and TH 52.

5.2 North–South Roadway Facility Types and Functional Classification

As stated previously, 40th Avenue was modeled to reflect a likely future connection between Eastwood Road and 20th Street. If built, the 40th Avenue connection may be classified as either a Major Collector or even a Minor Arterial. Even though initial forecasts indicate that 40th Avenue could be built as a two-lane roadway between TH 14 and Eastwood Road, its future facility type should be examined further from a system context. From a system standpoint, creating a three-lane or four-lane arterial in the project area between TH 14 and TH 52 would enhance mobility when the project area urbanizes. Further study of both the proposed 40th Avenue connection and existing 50th Avenue (CSAH 11) between TH 14 and TH 52 should be considered to better determine if it is feasible to construct either roadway as a three-lane or four-lane facility.

Also, with the construction of the 40th Avenue connection between Eastwood Road and 20th Street, approximately 5,000 vehicles per day are expected to use the roadway (with the Development). The current Marion Road / 40th Avenue intersection is located approximately 200 feet northwest of the Marion Road / 29th Street intersection. At this location, Marion Road runs northwest-southeast, 40th Avenue runs north-south, and 29th Street runs east-west. 29th Street, via 45th Avenue and Countrywood Drive, provides a connection between Marion Road and 50th Street. With the addition of background and development traffic volumes, the close spacing of these intersections could potentially decrease operations and increase the number of crashes at each intersection and on Marion Road. Two improvements that should be considered for implementation to either increase the spacing between the intersections or remove one of the intersections include:

1. Relocate the Marion Road / 40th Avenue intersection approximately 900 feet to the northwest, which would result in an intersection spacing of approximately 1,100 feet, OR
2. Realign 40th Avenue to intersect perpendicular to Marion Road and realign 29th Street to intersect 40th Avenue instead of Marion Road.

Either of the alternatives listed may require the acquisition of right-of-way in residential areas.

5.3 East-West Roadway Facility Types and Functional Classification

Eastwood Road currently has a functional classification of “local” roadway and is considered a secondary roadway under the ROCOG index of congestion guidelines. Traffic forecasts with the proposed development indicate that the roadway is expected to operate at acceptable levels as a two-lane roadway. However, if this roadway were upgraded from a secondary roadway to a primary roadway, it would be considered congested because it is expected to operate at a LOS D. According to the ROCOG index of congestion, the LOS C/D boundary is used for primary roadways. Further study of Eastwood Road should be considered to better determine if it is feasible to construct the roadway as a three-lane facility. Also, consideration could be given to preserving right-of-way along Eastwood Road for potential future construction of a three-lane roadway facility.

5.4 Road Spacing and Right-of-Way Needs

Table 5-1 is a summary table of typical design guidelines by functional classification. The table provides an indication of spacing between roadways of the same or higher classification. It also provides a range right-of-way requirements for each type of roadway. Based on this table, the proposed 40th Avenue and 20th Street roadway connections would require upwards of 120 feet of right-of-way. This table was developed from guidelines established by several of the counties making up the Twin Cities Metropolitan Area.

Table 5-1

Typical Design Guidelines by Functional Classification

Functional Classification	ADT Range (vpd)	Spacing *	R-O-W Requirements (feet)	Access Spacing	Number of Lanes	Width (feet)	Design Speed (mph)	Turn Lanes
Local	< 1,000	200' - 300' (1 block)	50 - 80	As Needed	2	32 - 36	30	None
Collector	1,000 - 15,000	1/2 - 1 mile	60 - 100	200' - 300' (1 block)	2,3	36 - 48	35 - 40	Left Turn Lanes at Major Intersections
Minor Arterial	5,000 - 30,000	1 - 2 miles	80 - 120	1/4 mile	2,3,5	36 - 64	40 - 50	Left Turn Lanes at All Intersections
Major Arterial	15,000 - 60,000	2 - 3 miles	100 - 150	1/2 mile	2,3,5	36 - 88	40 - 50	Left Turn and Right Turn Lanes at All Intersections
Freeway	25,000 - 200,000	3 - 5 miles	200 - 400	Grade Separated	4,6	100 - 200 (Median Dependant)	70	N.A.

* Between two parallel roadways of same or higher functional classification

6.0 OTHER TRAVEL MODES

6.1 Bike and Pedestrian Travel

The ROCOG travel demand model used to develop the traffic forecasts for this report generates vehicle trips. This means that the trips generated by the model are trips completed by passenger vehicles only. Future pedestrian and bike trips would occur outside of the domain of the forecasting model. Typical rules of thumb state that bike and pedestrian travel make up less than five percent of total vehicle trips made. Because of this, these two modes of travel are not expected to have a direct effect on roadway needs in the project area, but will affect the road right-of-way needs where trails are commonly built. It should be noted however, that the ROCOG Long-Range Transportation Plan provides detail as to the location of existing bike and pedestrian trails as well as the planned location of future trails. Once implemented, these trail extensions would provide an alternative mode of commuter travel as well as act as a recreational amenity.

6.2 Transit

Today, two fixed route transit lines serve the AUAR project area. Route 4 Travels between the Parkside Store on Marion Road and downtown Rochester. Route 4 buses travel on Park Lane and Marion Road in the project area as far south as the Parkside Store and then travel north out of the project area on 15th Avenue and 6th Street into downtown. Monday through Friday, route 4 buses operate at half-hour headways during the AM and PM peak periods and at one-hour headways during the midday. Limited service is available on Saturdays. The route serves approximately 340 trips per day on Monday through Friday.

A number of households in the project area were surveyed in 1997 to determine interest in fixed route bus service. The results of the survey indicated a high level of interest in transit service. Based on this survey, Route 17 was established in the project area. Buses on Route 17 travel on TH 14, 50th Avenue (CSAH 11) and Marion Road in the project area. The route operates on Monday through Friday during the AM and PM peak periods. Service is provided at half-hour headways during the AM peak hour and one-hour headways during the PM peak hour. The route serves approximately 80 trips per day.

The City of Rochester tracks performance of its transit routes and decisions regarding the establishment or continuation of service are based on review of fiscal and operating measures and how they compare to established service standards. Decisions to maintain transit service in the study area will be based on the demand for service and whether the service can be provided in a cost-effective manner.

7.0 SUMMARY/CONCLUSIONS

EXISTING CONDITIONS

The key intersections selected in southeast Rochester for analysis as part of this traffic study include:

1. TH 14 / Marion Road
2. TH 14 / 40th Avenue
3. Marion Road / Eastwood Road
4. Marion Road / 20th Street
5. Marion Road / 40th Avenue

The key roadways selected in southeast Rochester for analysis as part of this traffic study include:

1. TH 14 from 11th Ave (CSAH 1) to 50th Ave (CSAH 11)
2. Marion Road (CSAH 36) from TH 14 to 30th St
3. Eastwood Road (CR 144) from Marion Rd (CSAH 36) to 40th Ave
4. 20th Street (CR 143) from Marion Rd (CSAH 36) to 50th Ave (CSAH 11) – plus possible future connection from 11th Ave (CSAH 1) to Marion Rd (CSAH 36)
5. 40th Avenue from TH 14 to Eastwood Rd (CR 144) – plus possible future connection from Eastwood Rd (CR 144) to 20th St (CR 143)
6. Pinewood Road from 11th Ave (CSAH 1) to 30th Ave
7. 30th Avenue from Marion Rd (CSAH 36) to Pinewood Rd
8. 50th Avenue (CSAH 11) from TH 14 to CR 143 (N JCT)

An examination of the existing count data revealed the following information:

- PM Peak Hour: 4:45 PM – 5:45 PM
- Peak Hour Percentage of Daily Trips: 8%
- Directional Split of Traffic During PM Peak Hour: 60% / 40% (i.e. 60% of the two-way traffic will be traveling in one direction during the PM peak hour on the key roadways)

By completing a Level-of-Service analysis and comparing the results to the ROCOG index of congestion, the following deficiencies were identified:

- The TH 14/Marion Road intersection operates at LOS D in the PM peak hour.
- During the PM peak hour, queues from the north approach of the TH 14/Marion Road intersection were observed extending past a commercial access to a grocery store, effectively impeding access. Also, a queuing analysis revealed that vehicles turning left from the south approach during the PM peak hour will periodically exceed the available storage length and impact the adjacent through lane.

YEAR 2025 LAND DEVELOPMENT SCENARIO

- The future land development expected to occur in the project area between now and 2025 is generalized as follows:
 - 3,160 Single-Family Dwelling Units
 - 3,140 Multi-Family Dwelling Units
 - 180 Elderly/Senior Housing Dwelling Units
 - 1,760 Square Feet of General Commercial Development
 - 130,000 Square Feet of Neighborhood Commercial Development
 - 579,500 Square Feet of Industrial Development
 - 33 Acres of Undeveloped Parkland

It should be noted that the 130,000 square feet of neighborhood commercial development projected to develop in the project area was not included in the TAZ distribution. This was because the unstable market forces that bring about this type of development make it exceedingly difficult to accurately predict at the TAZ level where this development would likely occur. Future neighborhood commercial developments occurring in the project area may necessitate a separate analysis of traffic impacts

YEAR 2025 TRAFFIC FORECASTS

- Year 2025 traffic forecasts were initially developed for two scenarios, which include:
 - Year 2025 No-Development Scenario: Assumes that no new land development and no roadway improvements would be made in the project area between now and 2025.
 - Year 2025 Development Scenario: Assumes hypothetical land development scenario would be established in the project area by 2025. Scenario also assumes that a new 40th Avenue connection between Eastwood Road and 20th Street would be constructed in the study area.
- Peak hour and ADT traffic forecasts for all scenarios were developed using the Rochester-Olmsted County Council of Governments (ROCOG) Travel Demand Model. ROCOG staff provided year 2025 ADT model assignments for the forecast scenarios analyzed. These ADT model assignments were used to develop ADT forecasts for the key roadways.

YEAR 2025 NO-DEVELOPMENT SCENARIO

- The no-development scenario assumes that no new land development and no roadway improvements would be made in the project area between now and 2025.
- For the no-development scenario, the traffic forecasts indicate that the traffic volumes on TH 14 from west of Marion Road to East Circle Drive are expected to increase by approximately 85% to 100%. Also, Pinewood Road is expected to increase by approximately 100% by the Year 2025.
- With the increase in background traffic volumes, the roadway segment of TH 14 east of 40th Avenue is expected to operate at a LOS D.

- During the PM peak hour, the TH 14/Marion Road and Marion Road/Eastwood Road intersections are expected to operate at a LOS F. Also, at the TH 14/Marion Road intersection, the queues on the north, south, and west approaches are expected to spillback through the adjacent intersections.
- Based on the roadway and intersection LOS results, the following improvements were identified:
 1. Reconstruct the TH 14 / Marion Road intersection to accommodate dual left turns, two through lanes, and a right turn lane on all approaches.
 2. Install a traffic signal at the Marion Road/Eastwood Road intersection. (Along with installing a traffic signal at the Marion Road/Eastwood Road intersection, the relocation of the Eastwood Road approach to approximately 600 feet to the south of its existing location should be considered even though it is not required. Doing this would allow the intersection to meet Mn/DOT's recommended minimum spacing guidelines between signalized intersections and to provide adequate distance between intersections such that the zones of influence that effect drivers do not overlap. However, it should be noted that relocation of the intersection would require additional right-of-way, potential property acquisitions and significant grading of the existing steep, forested slopes.)
 3. Construct TH 14 as a four-lane expressway east of 40th Avenue through the 50th Avenue intersection. Improve the sight distance on TH 14 at the 40th Avenue intersection by reconstructing the vertical alignment on TH 14 to provide more gradual vertical grade changes near the 40th Avenue intersection.

YEAR 2025 DEVELOPMENT SCENARIO

- Using the trip generation equations from the ROCOG travel demand model, over 59,000 trip ends were estimated to be generated by the projected land development.
- Under the development scenario, a 40th Avenue connection between Eastwood Road and 20th Street was assumed to be built for two primary reasons.
 1. As land areas become more urban, a higher density of functionally classified roadways are needed to maintain an adequate level of access and mobility in the area. Typical standards indicate that in developing areas, Minor Arterials should be spaced at one to two-mile intervals with Major and Minor Collectors spaced at the half-mile or mile-point in-between.
 2. If the land adjacent to the 40th Avenue corridor develops at the intensity proposed, it is likely that some sort of direct or in-direct connection between Eastwood Road and 20th Street will be necessary in order to provide a reasonable degree of circulation and access to the proposed development.
- The implication of these two reasons for assuming a 40th Street connection is that this connection would, to some degree, serve longer distance trips within the region while also providing some level of access to the adjacent development. The degree to which 40th Avenue provides mobility over access (i.e. Minor Arterial versus Major/Minor Collector) will depend on the future combination of roadways and development in the area.

- Based on the year 2025 development scenario forecasts, the key roadway and intersection deficiencies are expected be as follows:

LOS Deficient Roadways

- o TH 14 east of 40th Avenue (expected to operate at a LOS D)
- o Marion Road between TH 14 and Eastwood Road (expected to operate at a LOS E)
- o Marion Road between 20th Street and 40th Avenue (expected to operate at a LOS E)

LOS Deficient Intersections

- o TH 14/Marion Road Intersection (LOS F in AM and PM peak hour)
- o Marion Road/Eastwood Road Intersection (LOS F in AM and PM peak hour)
- o TH 14/40th Avenue Intersection (LOS F in AM and PM peak hour)

Intersections with Queuing Deficiencies

- o During the PM peak hour, TH 14/Marion Road Intersection is estimated to create queues extending through the TH 14/11th Avenue intersection to the west and the Marion Road/Eastwood Road intersection to the south. Also, the queues on the north approach are expected to block access to local businesses.
- For the purposes of this report, “improvements” are defined as roadway enhancements needed to eliminate deficiencies that are expected to occur under the 2025 no-development scenario. “Mitigations” are defined as roadway enhancements that are required to eliminate the additional 2025 deficiencies that are associated solely with the development scenario.
- The following is a list of the improvements and mitigation measures identified to eliminate the key roadway and intersection deficiencies for the year 2025 development scenario:

Roadway and Intersection Improvements

(Improvements are enhancements recommended under the 2025 no-development scenario)

1. Reconstruct the TH 14 / Marion Road intersection to accommodate dual left turns, two through lanes, and a right turn lane on all approaches.
2. Install a traffic signal at the Marion Road / Eastwood Road intersection. Along with installing a traffic signal at the Marion Road/Eastwood Road intersection, the relocation of the Eastwood Road approach to approximately 600 feet to the south of its existing location should be considered even though it is not required. Doing this would allow the intersection to meet Mn/DOT’s recommended minimum spacing guidelines between signalized intersections and to provide adequate distance between intersections such that the zones of influence that effect drivers do not overlap (see discussion in Section 3.2.1).
3. Construct TH 14 as a four-lane expressway east of 40th Avenue through the 50th Avenue intersection. Also, improve the sight distance on TH 14 at the 40th Avenue intersection by reconstructing the vertical alignment on TH 14 to provide more gradual vertical grade changes near the 40th Avenue intersection.

Roadway and Intersection Mitigations

(Mitigations are enhancements recommended under full build out of the 2025 development scenario in order to achieve desired levels-of-service. They would be in addition to the improvements listed above.)

1. At the TH 14 / 40th Avenue intersection:
 - o Install a traffic signal with “exclusive” only left turn phasing for all approaches.
 - o Construct the south approach to accommodate dual left turn lanes, a through lane, and a right turn lane.
 - o Construct the north approach to accommodate a left turn, through, and right turn lane to complement the geometry on the south approach.
 2. Construct Marion Road as a four-lane divided roadway between 20th Street and 40th Avenue.
- Because it was determined that the TH 14/Marion Road intersection is expected to operate at LOS D during the PM peak hour even if the intersection was improved as described previously, an analysis examining the effects of constructing a new 20th Street connection between Marion Road and 11th Avenue (CSAH 1) was conducted. Specifically, the analysis examined the effect of all improvements and mitigations with and without the 20th Street connection. The analysis found that with the 20th St connection, the intersection of Marion Road and TH 14 would operate at an overall Level of Service of C, compared to LOS D without the connection. All individual movements would operate at an acceptable Level of Service regardless if the 20th Street connection were built.
 - In order to better determine what level of the proposed development may trigger LOS D or worse conditions at the TH 14/Marion Road intersection (assuming all improvements to the intersection are implemented), an analysis was completed to determine the traffic level at which the LOS at the intersection would clearly become LOS D. The analysis revealed that LOS D conditions would likely occur at the TH 14/Marion Road intersection when traffic volumes at the intersection exceed 85% of the levels projected in the full development scenario. In order to provide enough time for study prior to reaching 85% of projected full traffic levels, it is suggested that a new 20th Street connection be studied after traffic volumes exceed 70% of the projected volumes associated with full development in the study area. This should provide enough time to determine if 20th Street may be needed before conditions at the TH 14/Marion Road intersection deteriorate below a LOS C.

- If the extent of development and traffic growth requires consideration of the 20th St connection, the following ancillary improvements at the Marion Road/20th Street intersection and the Marion Road/40th Avenue intersection should be considered:

Roadway and Intersection Mitigations Needed if New 20th Street Connection is Programmed

1. At the Marion Road/20th Street intersection:
 - o Install a traffic signal with “exclusive/permitted” left turn phasing for all approaches.
 - o Design Marion Road (north and south approaches) to provide a left-turn lane, two through lanes, and a right-turn lane.
 - o Design 20th Street (east and west approaches) to provide a left-turn lane, at least one through lane, and a right-turn lane.
2. At the Marion Road/40th Avenue intersection:
 - o Design the 40th Avenue approach to provide a left-turn lane and right-turn lane.
 - o Design the Marion Road north approach to provide a left-turn lane and through lane.
 - o Design the Marion Road south approach to provide a through lane and right-turn lane.

IMPROVEMENT AND MITIGATION PLAN

Traffic Signal Installation

- Mn/DOT has established and recently published recommended access/signal spacing guidelines for different functionally classified roadways (e.g. high priority interregional corridors, principal arterials, collector arterials, etc.). Based on these guidelines, installation of traffic signals at the TH 14/40th Avenue and Marion Road/20th Street intersections would be in compliance with these guidelines.
- Currently, the spacing between the TH 14 and Eastwood Road on Marion Road is approximately 800 feet. Installation of a traffic signal at the Marion Road/Eastwood Road intersection would not meet the minimum Mn/DOT’s spacing guideline of 1,320 feet (1/4 mile). Moving the intersection to the south could potentially improve safety at the intersection (see discussion in Section 3.2.1 for more information). However, relocation of the signal would require additional right-of-way, potential property acquisitions, and the grading of steep slopes.
- Prior to installation of a traffic signal, a Signal Justification Report (SJR) would need to be completed.

Jurisdictional Issues

- The key roadways listed in the Project Area are owned and maintained by different agencies, which include Mn/DOT, Olmsted County the City of Rochester, and Marion Township. If it is determined that improvements and/or mitigations are necessary to improve the traffic operations at a particular intersection or roadway section, coordination should occur between the governing agencies of the roadways to develop an improvement/mitigation strategy, and determine right-of-way acquisition, etc..

Traffic Monitoring for Improvements/Mitigations

- The proposed development is expected to occur incrementally over the next 25 years in the project area. Therefore, implementation of all improvement and mitigations listed are not expected to be needed immediately or at the same time.
- It must be remembered that the development scenario examined here is a hypothetical scenario. If the location of future land development in the project area deviates significantly from the proposed scenario, then the traffic impacts and ensuing potential improvements and mitigations might differ from what has been presented in this report.
- Given that there are many uncertainties surrounding the timing and need for roadway improvements associated with development in the study area, it is recommended that the initial mitigation strategy associated with traffic impacts should be the establishment of a traffic monitoring program to track traffic growth on area roadways.
- Several locations were listed where hourly approach volumes over a 48-hour time period could be collected. These hourly approach volumes could then be averaged and summed over a 24-hour time period to develop average daily traffic volumes. These daily traffic volumes could then be used as a guideline to determine if a more detailed analysis is needed.
- As a recommendation, the appropriate roadway authorities should monitor the specific locations where development is expected to occur at least every four years. If the city receives a request for a large development occurring in the interval between monitoring years, a Traffic Impact Study, consistent with the requirements of the City of Rochester, will be needed to assess the impact of the development on study area streets in the immediate area.

FUTURE SYSTEM AND RIGHT-OF-WAY CONSIDERATIONS

- If the 40th Avenue connection were built, the roadway may be classified as either a Major Collector or even a Minor Arterial. Even though initial forecasts indicate that 40th Avenue could be built as a two-lane roadway between TH 14 and Eastwood Road, its future facility type should be examined further from a system context. From a system standpoint, creating a three-lane or four-lane arterial in the project area between TH 14 and TH 52 would enhance mobility when the project area urbanizes.
- The current Marion Road / 40th Avenue intersection is located approximately 200 feet northwest of the Marion Road / 29th Street intersection. With the addition of background and development traffic volumes, the close spacing of these intersections could potentially decrease operations and increase the number of crashes at each intersection and on Marion Road. Two improvements that could be implemented include:
 1. Relocate the Marion Road / 40th Avenue intersection approximately 900 feet to the northwest, which would result in an intersection spacing of approximately 1,100 feet, OR
 2. Realign 40th Avenue to intersect perpendicular to Marion Road and realign 29th Street to intersect 40th Avenue instead of Marion Road.

Either of the alternatives listed may require the acquisition of right-of-way in residential areas.

- Traffic forecasts on Eastwood Road with the proposed development indicate that the roadway is expected to operate at acceptable levels as a two-lane roadway. However, if this roadway were upgraded from a secondary roadway to a primary roadway, it would be considered congested because it is expected to operate at a LOS D, according to the ROCOG index of congestion. Further study of Eastwood Road should be considered to better determine if it is feasible to construct the roadway as a three-lane facility. Also, consideration could be given to preserving right-of-way along Eastwood Road for potential future construction of a three-lane roadway facility.

OTHER TRAVEL MODES

Bike and Pedestrian Travel

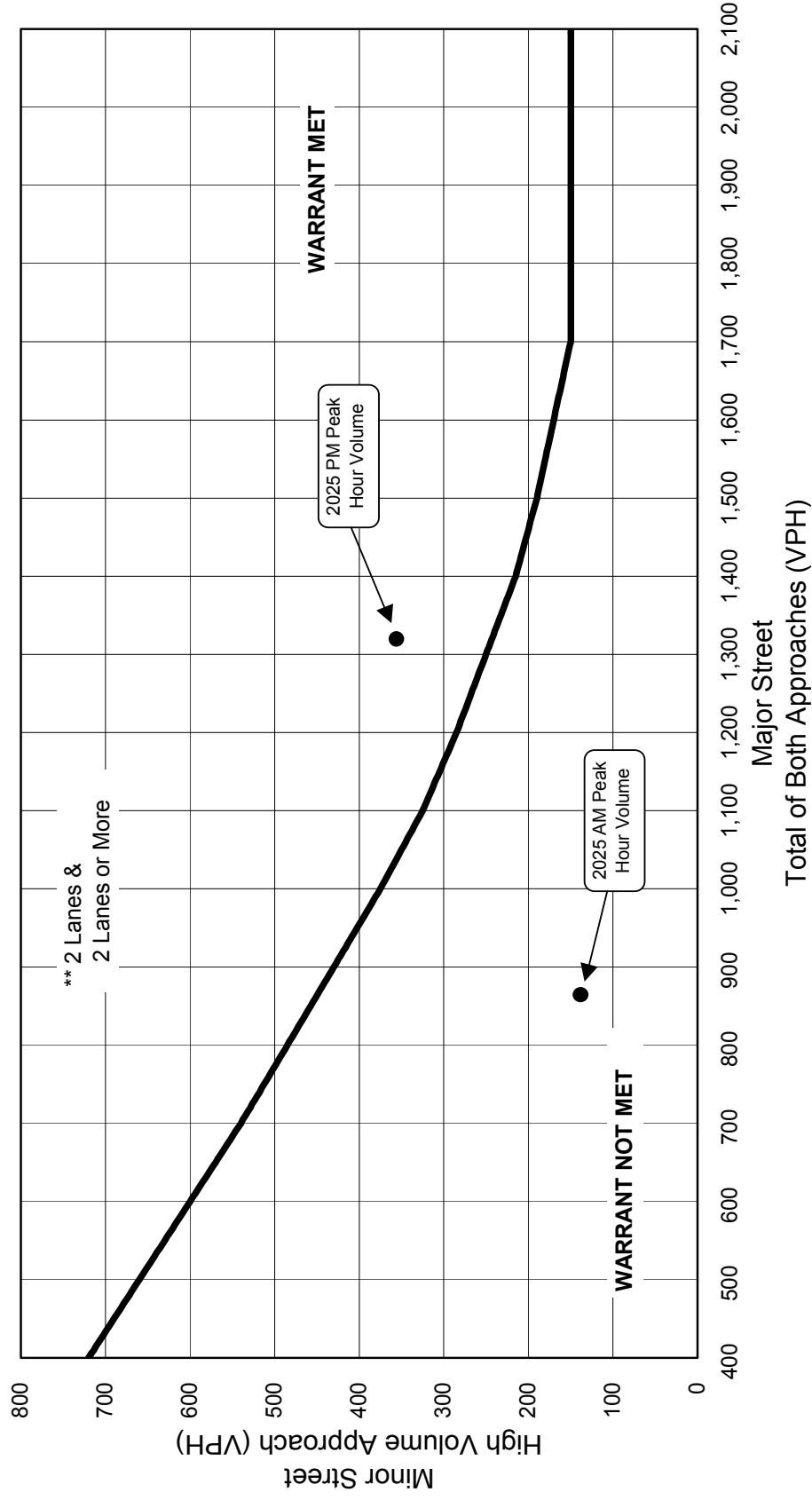
- The ROCOG travel demand model used to develop the traffic forecasts for this report generates vehicle trips. This means that the trips generated by the model are trips completed by passenger vehicles only. Future pedestrian and bike trips would occur outside of the domain of the forecasting model. Typical rules of thumb state that bike and pedestrian travel make up less than five percent of total vehicle trips made. Because of this, these two modes of travel are not expected to have a direct effect on roadway needs in the project area, but will affect the road right-of-way needs where trails are commonly built.
- It should be noted that bike and pedestrian trail extensions are being planned for the project area. The ROCOG Long-Range Transportation Plan provides detail as to the location of existing bike and pedestrian trails as well as the planned location of future trails. Once implemented, these trail extensions would provide an alternative mode of commuter travel as well as act as a recreational amenity.

Transit

- There are currently two fixed-route transit lines that service the Project Area.
- A survey was conducted in 1997 to determine interest in an additional fixed route bus service for the Project Area. The results of the survey indicated a high level of interest in transit service. Based on this survey, an additional route was established in the project area.
- The City of Rochester tracks performance of its transit routes and decisions regarding the establishment or continuation of service are based on review of fiscal and operating measures and how they compare to established service standards. Decisions to maintain transit service in the study area will be based on the demand for service and whether the service can be provided in a cost-effective manner.

ATTACHMENT A

**NO-DEVELOPMENT PEAK HOUR WARRANT ANALYSIS
For the Marion Road/Eastwood Road Intersection**



Warrant Met for 1 Hours

* NOTE: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes.

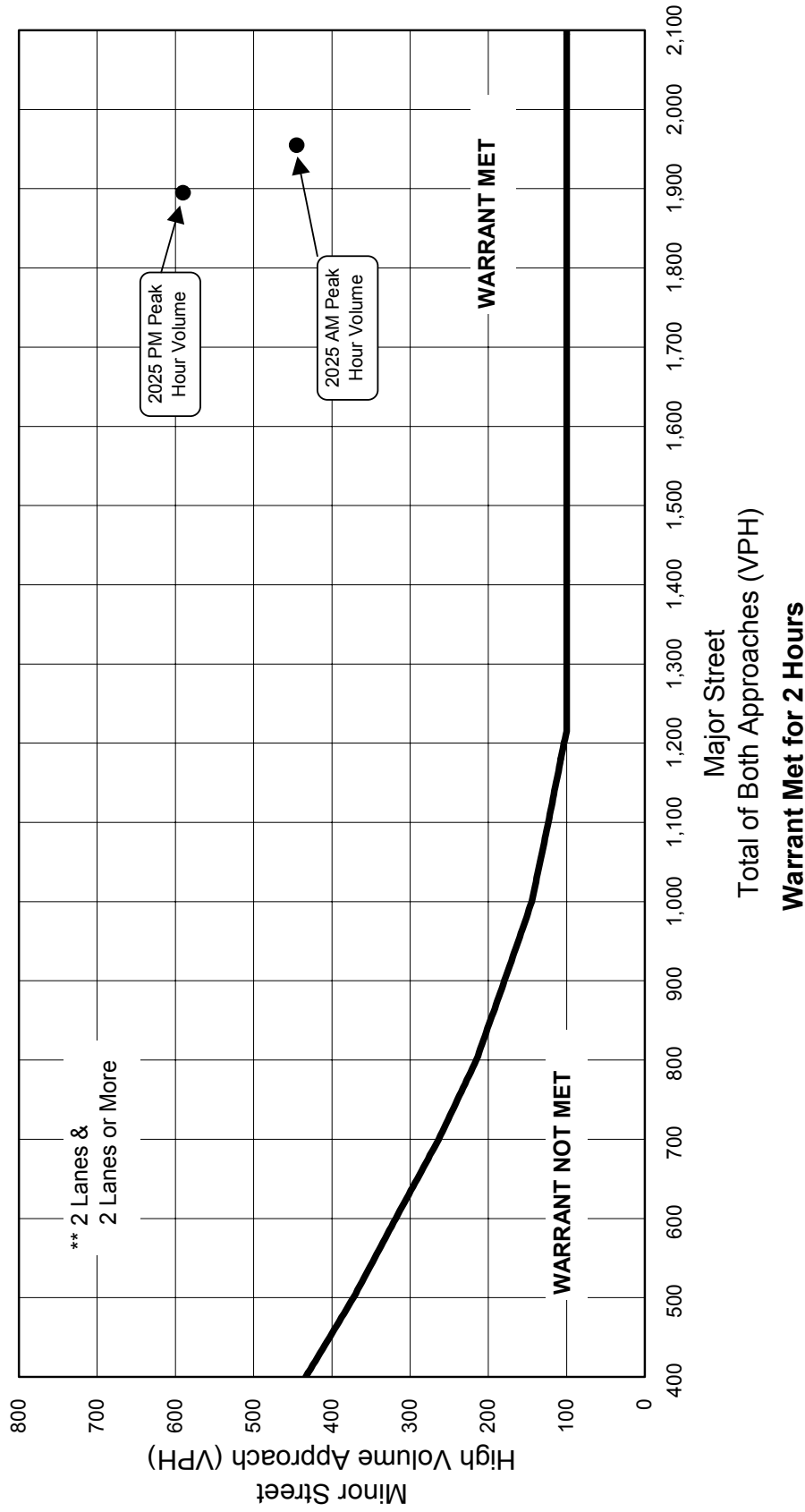
** The first number refers to the number of lanes of approach on the major street and the second number refers to the number of lanes of approach on the minor street.

Marion Rd / Eastwood Rd - With No-Build Volumes Signal Warrant Analysis

Warrant 11 - Peak Hour Volume Warrant

ATTACHMENT B

**DEVELOPMENT PEAK HOUR WARRANT ANALYSIS
For the TH 14/40th Avenue
And Marion Road/Eastwood Road Intersections**

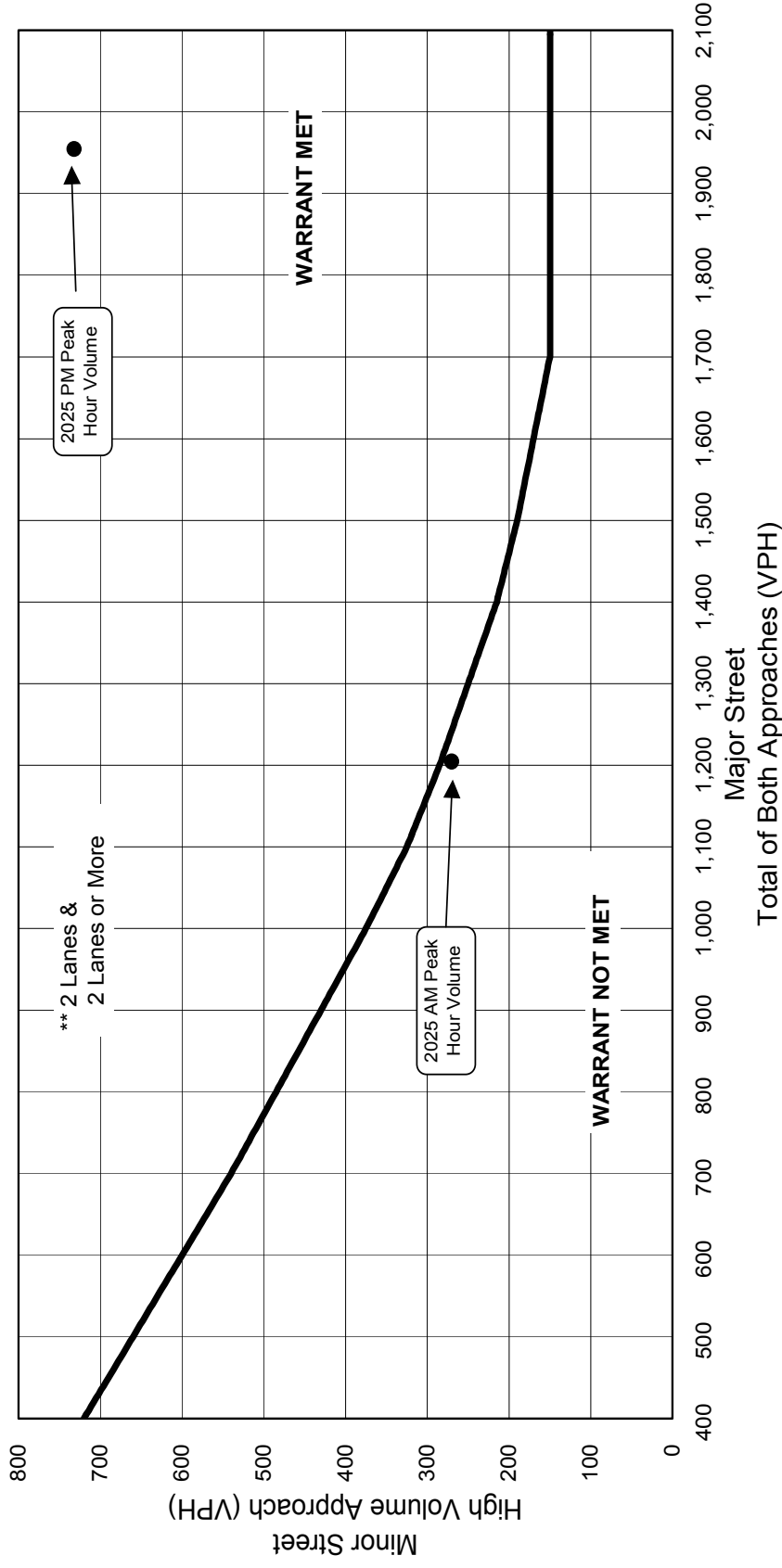


NOTE: 100 vph applies as the lower threshold volume for a minor street approach with two or more lanes.

** The first number refers to the number of lanes of approach on the major street and the second number refers to the number of lanes of approach on the minor street.

TH 14 / 40th Avenue - With Proposed Development
Signal Warrant Analysis

Warrant 11 - Peak Hour Volume Warrant
(Speed above 40 MPH on Major Street)



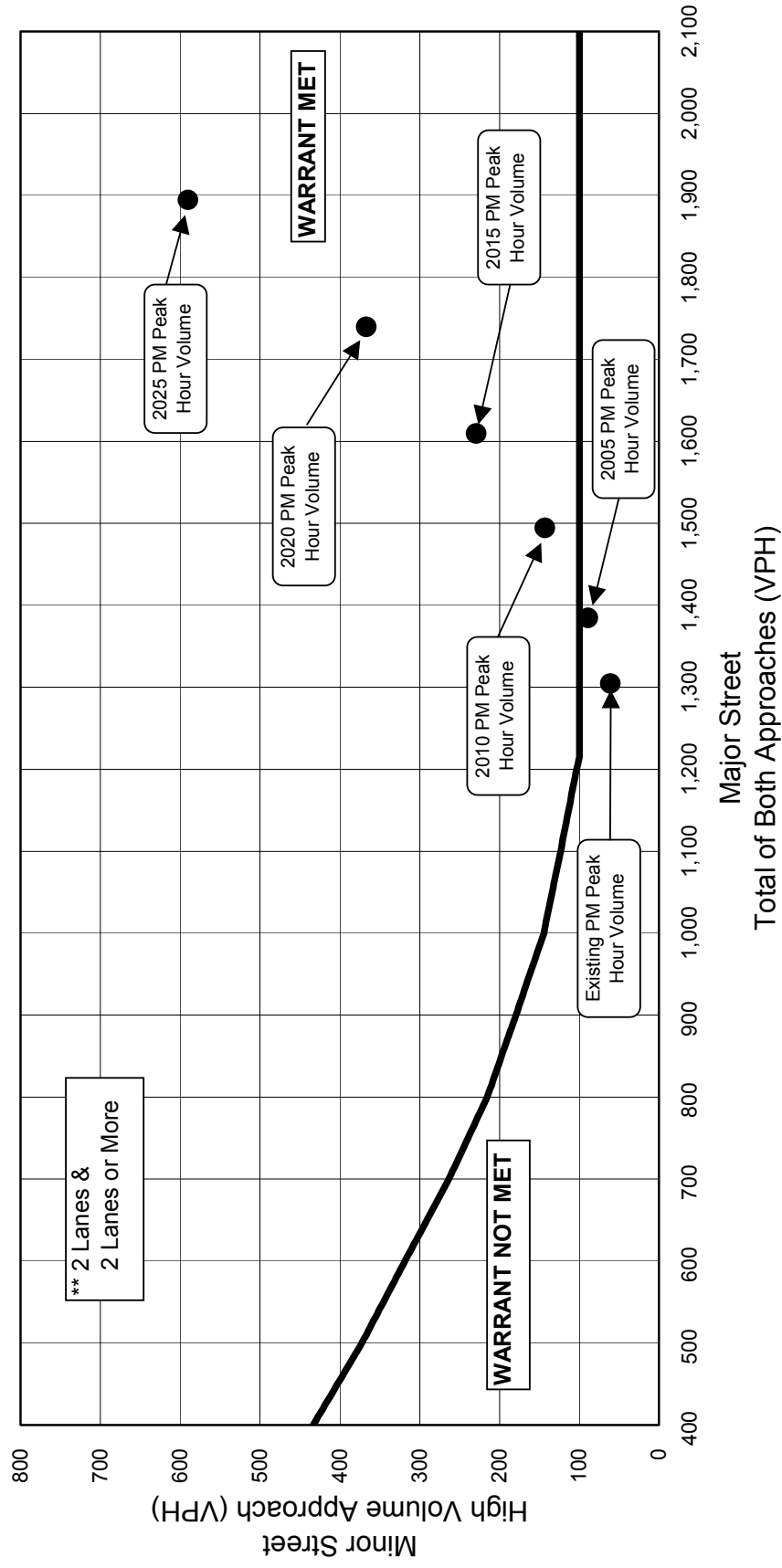
Warrant Met for 1 Hours

* NOTE: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes.

** The first number refers to the number of lanes of approach on the major street and the second number refers to the number of lanes of approach on the minor street.

**Marion Rd / Eastwood Rd - With Proposed Development
Signal Warrant Analysis**

**Warrant 11 -
Peak Hour Volume Warrant**

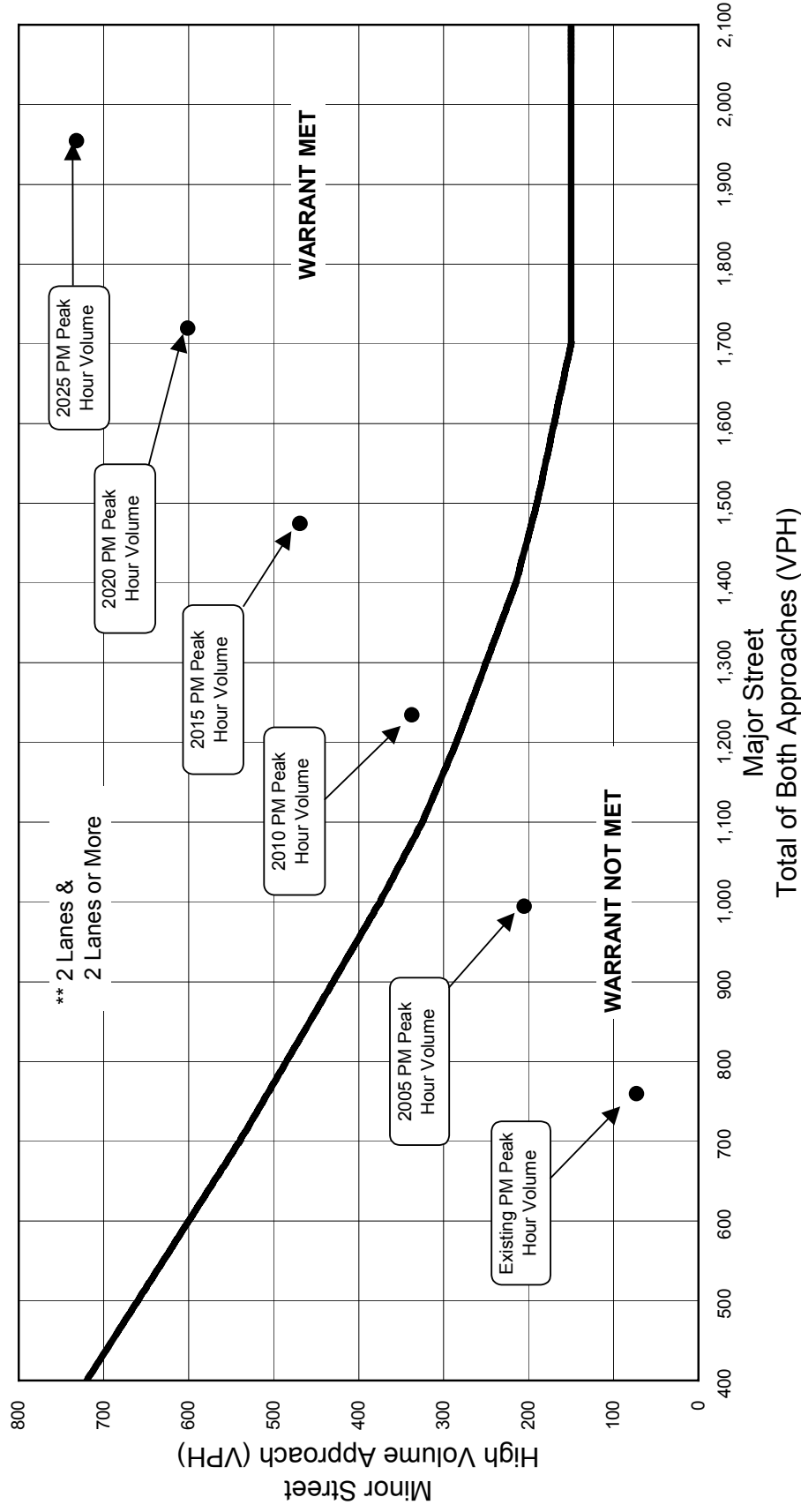


NOTE: 100 vph applies as the lower threshold volume for a minor street approach with two or more lanes.

** The first number refers to the number of lanes of approach on the major street and the second number refers to the number of lanes of approach on the minor street.

**TH 14 / 40th Avenue - With Proposed Development
Signal Warrant Analysis**

**Warrant 11 - Peak Hour Volume Warrant
(Speed above 40 MPH on Major Street)**



Warrant Met for X Hours

* NOTE: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes.

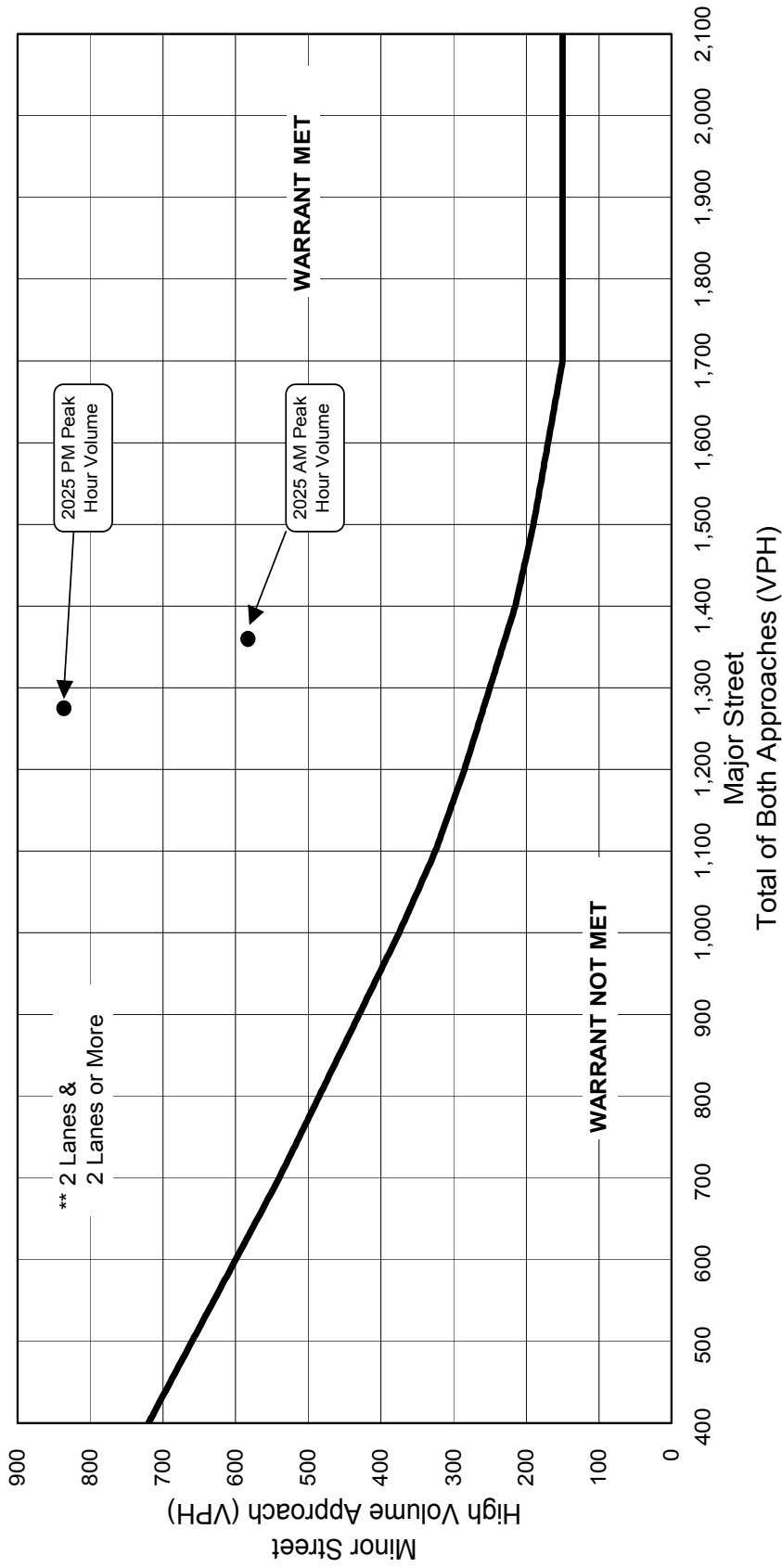
** The first number refers to the number of lanes of approach on the major street and the second number refers to the number of lanes of approach on the minor street.

Marion Rd / Eastwood Rd - With Proposed Development
Signal Warrant Analysis

Warrant 11 -
Peak Hour Volume Warrant

ATTACHMENT C

**DEVELOPMENT PEAK HOUR WARRANT ANALYSIS
Marion Road/20th Street Intersection**



* NOTE: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes.
 ** The first number refers to the number of lanes of approach on the major street and the second number refers to the number of lanes of approach on the minor street.

Marion Rd / 20th St - With Proposed Development

and 20th St Connection
 Signal Warrant Analysis

**Warrant 11 -
 Peak Hour Volume Warrant**